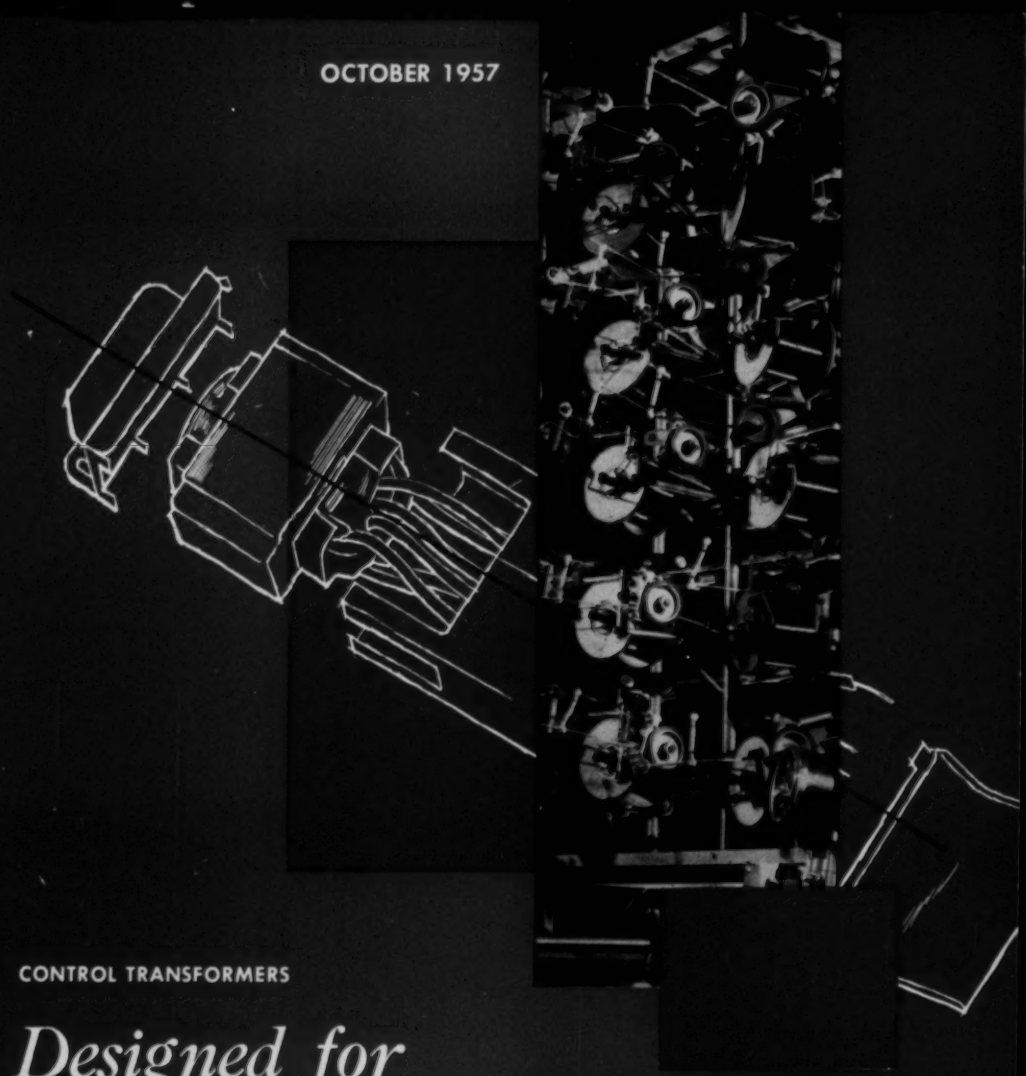
AUTOMATION

OCTOBER 1957



CONTROL TRANSFORMERS

Designed for Automatic Production

The Magazine of Automatic Operations

- Tooling for Automatic Assembly
- Evolution into Automation
- Hydraulic Pumps and Actuators
- Punched Card Control

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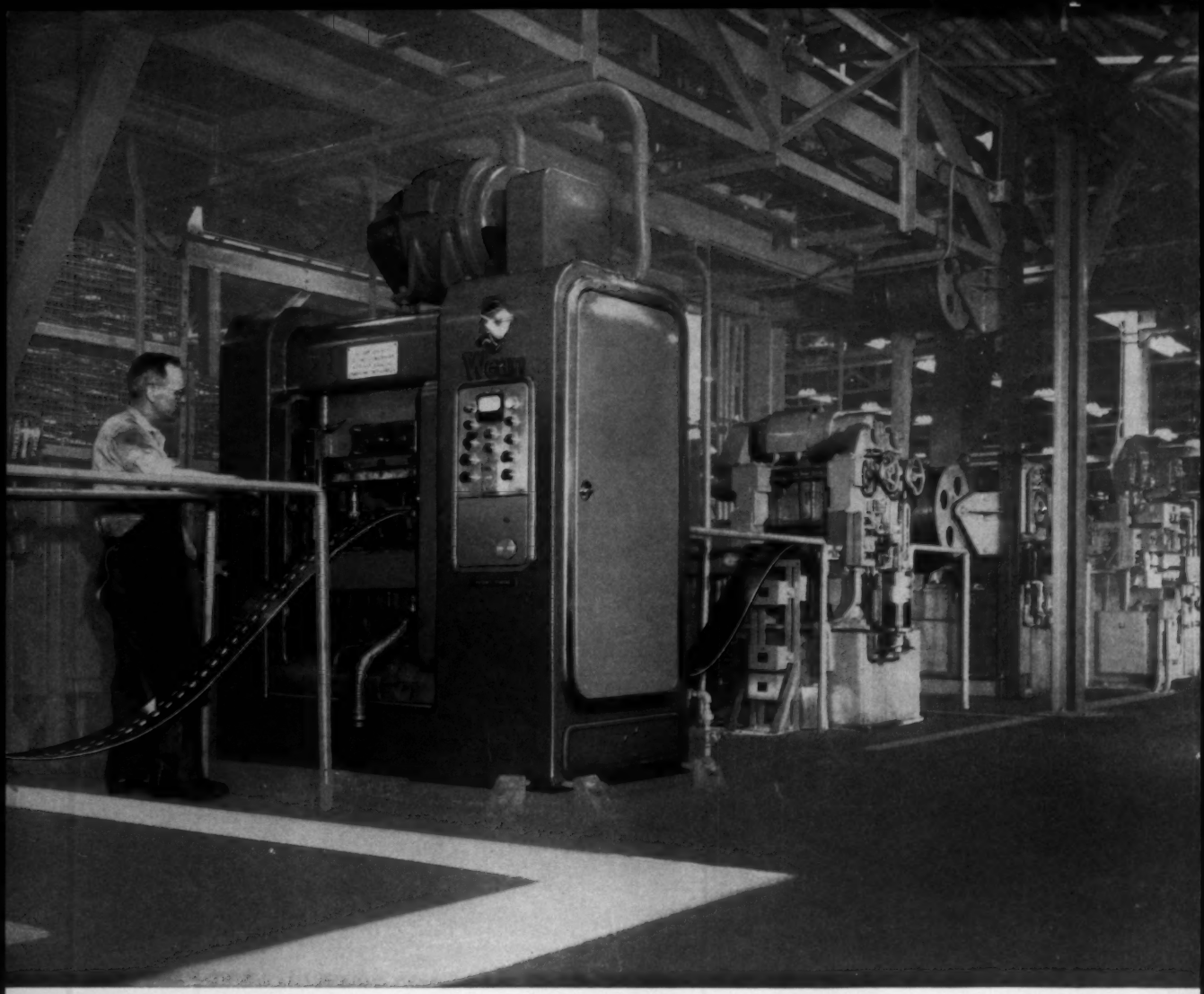

The Wean "Flying Press"

continuous strip feed eliminates stop-and-go operation in production lines

In many production lines utilizing conventional presses, the production rate of the entire line is governed by the speed of the press. Thus, though the balance of the line may have a higher production potential, actual production is curtailed by the old-fashioned stop-and-go action of the press. In the case of the Wean "Flying Press", however, the combination of a continuous feed principle plus speeds many times in excess of conventional press rates enables a production line to produce at maximum capacity.

High speed, automated and semi-automatic operations in particular benefit from the many revolutionary advantages inherent in the Wean "Flying Press".

Built in feed rolls — press feed, can be varied while press is running — all controls centralized .... these are but a few of the many features of the Wean "Flying Press". We could discuss simple floor mountings, ultra-high speed operation and many other advantages. However, you can get the complete story by writing today for your copy of the Wean "Flying Press" brochure.

Wean Equipment Corporation
CLEVELAND 17, OHIO

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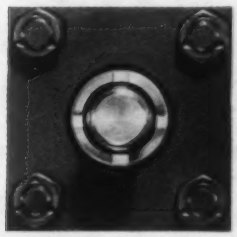
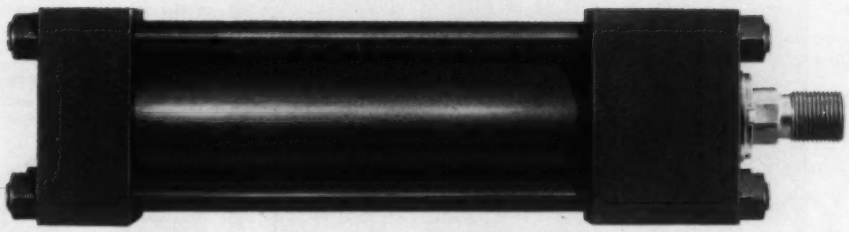


Made for the tough buyer



The discriminating engineer is intolerant—intolerant of anything but the very best in his plant and in his product.

For these tough buyers Hannifin cylinders are made. Into these cylinders go original, exclusive features of design, precision manufacture, and the ability to outperform others with the very minimum of maintenance.

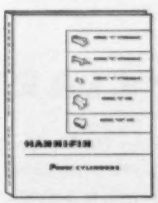
You would expect to pay more for Hannifin cylinders. Actually there is no price premium. We can deliver them to you promptly in the sizes and mounting styles you require.

AIR AND HYDRAULIC

HANNIFIN

POWER CYLINDERS

Write for your copy of this new Hannifin Cylinder File—complete, easy-to-use, easy-to-order-from information on five lines of Hannifin cylinders. Hannifin Corporation, 541 South Wolf Road, Des Plaines, Illinois.



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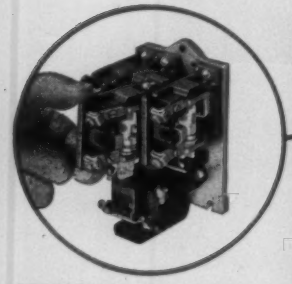
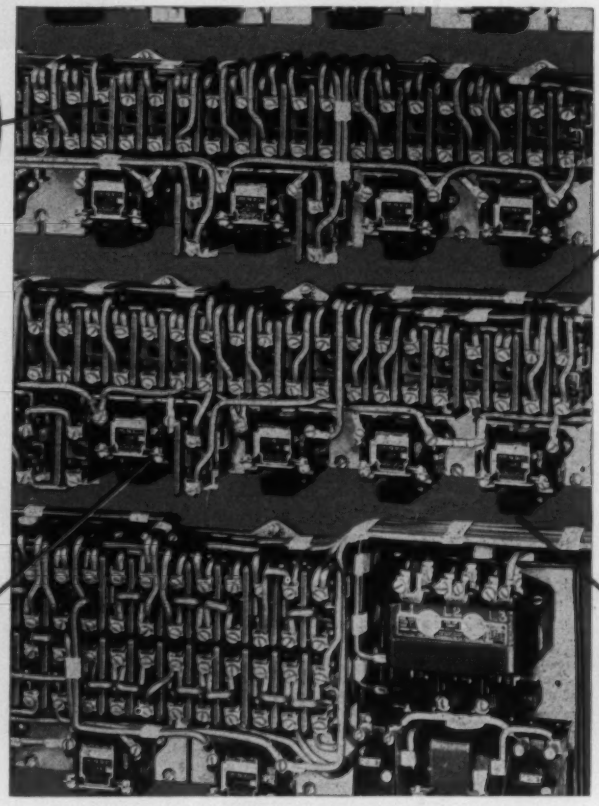
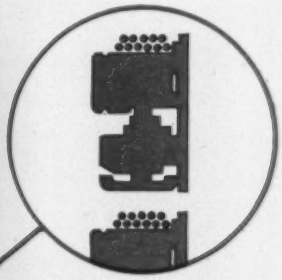
Why CLARK Type "PM" RELAYS give you more contacts per square foot of panel space!

Unique Features Produce Rugged Yet Compact Heavy-Duty Relay...

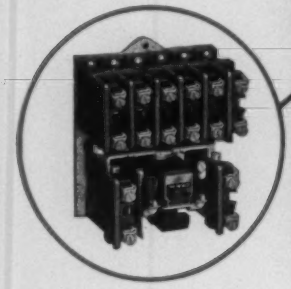


SECTIONAL POLE CONSTRUCTION. A Clark exclusive . . . With each pole in its individual melamine chamber, space between relays for electrical clearance is unnecessary. Front-mounted terminals eliminate need for extra side clearance. Sides of contact blocks are flush with edges of mounting plate.



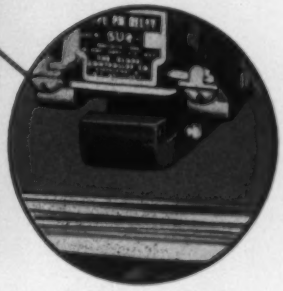


BUILT-IN WIRING SHELF . . . The melamine tops of the pole assemblies provide an insulating shelf free of current-carrying parts. Wiring can be bundled or laid flat right on top of the relay, saving additional space between rows. When wiring troughs are desired, they can be placed much closer to the top of the relay. This feature is another Clark exclusive.

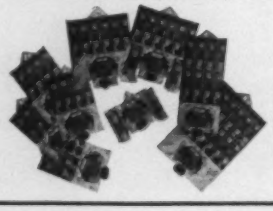


EIGHT-POLE SINGLE DECK . . . Only Clark makes it possible to have an eight-pole relay with single-deck wiring. At the same time, it uses every square inch of space on mounting plate, and lines up perfectly with Clark 2, 3, 4 and 6-pole single deck relays.

UNIFORM DIMENSIONS . . . Clark type "PM" relays are an integrated line designed so that they can be mounted side by side in perfect alignment with each other. In addition, the double-deck models have identical mounting dimensions with Clark type "CY", size 1 starters. Result: Neater, more uniform and more compact control panels.



⅞" MAGNET CLEARANCE . . . That's all the space needed to remove magnet and change coil. In overall panel construction and layout, this feature saves space by reducing amount of space between rows.



FREE TEMPLATES!

FREE TEMPLATES! Write for kit of actual-size photo-templates of type "PM" relays mounted on heavy cardboard. A great time-saver in laying out control panels. Each template has detailed dimension drawing and pole arrangement on the back.

The **CLARK** **CONTROLLER** *Company*

Everything Under Control

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OCTOBER 1957
Vol. 4—No. 10

AUTOMATION

A PENTON PUBLICATION

The Magazine of Automatic Operations

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automation outlook

ORIGINAL THINKING

". . . Automation has presented management with a major new problem. As yet management has not faced up to this problem and in fact is not even grappling with it in any true sense . . . most management thinking is cluttered with a whole set of stereotypes . . . Not only must these stereotypes be exposed for what they are before business can take full advantage of the genuine potential of automation, but management must do a good deal more original thinking and must learn to question traditional patterns of operation as well as the concepts of automation itself. . . The danger, it has been well said, is not in having pushbutton machines, but in being content with a 'pushbutton type of thinking'."—*John Diebold, president, John Diebold & Associates Inc.*

GREAT PROMISE

". . . Viewed in broad perspective, it becomes clear that automation holds forth great promise for the future. Its application should make a substantial contribution to both our material and social progress. In a world in which upwards of one billion people have average yearly incomes of less than 100 dollars, and in which millions of our own American families live on sub-standard levels, it will be a welcome addition to our arsenal in the battle against hunger and want. At the same time, as is the case with all progress, this newest of technologies has its attendant problems of economic and social adjustment. Unless these issues are met squarely and sensibly, the potential benefits of automation will not be translated with maximum results into improved levels of human well-being. . ."—*James C. Vadakin, professor of economics, University of Miami.*

WHAT TO AUTOMATE

". . . what to automate clearly depends on the evaluation of such factors as anticipated design life, the period over which an investment in automation must be amortized, and the cost reduction per unit achievable through automation. You must measure the cost elements of every operation in your plant against the cost of performing the same operation more automatically. When this is done, you may well find that you cannot afford not to automate . . ."—*W. R. G. Baker, vice president, General Electric Co.*

BRIGHT FUTURE

". . . the primary impact of automation on society will be to create new opportunities—opportunities for new skills, for raising standards of living, for increasing military strength, for earning a living in a more rewarding and interesting way, and opportunities for setting up profitable businesses in fields which may be almost unknown at present. It is elementary that long-run improvements in national economic welfare can have no other basis than increases in productivity. During the two centuries since the beginning of the industrial revolution the level of living in the Western World has been raised tremendously. The chief impact of automation will be to permit the continuation of this historical improvement of human welfare . . ."—*Malcolm P. Ferguson, president, Bendix Aviation Corp.*

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ERIEZ

MAGNETS In Automation

NEW IDEAS from Eriez

For fourteen years Eriez has specialized exclusively in the design, manufacture and sale of high quality permanent magnetic equipment for machinery and conveyor manufacturers, design engineers, contractors and direct users. Our unique knowledge in the field of magnetic design and application has developed through experience gained by working in hundreds of a wide variety of industrial problems.

Eriez does not design, build or sell material-handling systems, but we serve people who do in areas where magnetic equipment should be incorporated. We willingly share the design- and field-application know-how gained through helping others move materials faster, more economically, more efficiently, more accurately by utilizing the inherent advantages of magnetism. And, since our engineers work closely with both system manufacturer and ultimate user, the most efficient installation is the end result.

Specifically, we produce standard lines of magnetic equipment and, in addition, design and build special components to *magnetically* convey, transfer, control, elevate, re-position, hold or re-orient basic ferrous materials or finished parts. Result? . . . materials move faster, more economically, more efficiently, more accurately—with complete control. Eriez automation units increase production, while lowering production costs. More positive hold reduces damaged parts, improves safety conditions.

Let **ERIEZ** *solve your magnetic automation problem! We'll be glad to help you in your special automation needs. For information or assistance, contact your nearest Eriez representative, or write direct giving as much advance information as possible. No obligation, of course. Eriez Manufacturing Company, 119X Magnet Drive, Erie, Pennsylvania.*

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Eriez Magnetic Units provide these important AUTOMATION ADVANTAGES

- First cost is the only cost
- Powerful, self-contained magnets are virtually trouble-free
- Magnetic strength is guaranteed indefinitely
- No electrical accessories or wiring necessary
- No power consumption; no operating costs
- Maintenance is virtually eliminated
- Less work space is needed
- Positive hold permits faster conveyor speeds
- Simple design, simple in function
- Rugged design and construction; few moving parts
- Choice of surface facings: hard or rubber coated for finished parts
- Easily installed on new or existing equipment
- Wide range of styles, sizes, magnetic strengths
- No special skills or training needed to control, operate or maintain these units.

ERIEZ—pioneers and world's largest producer of permanent non-electric magnetic equipment for industry, has three major product lines to serve you:

HI-POWR MAGNETIC SEPARATORS—to remove unwanted iron from processing lines, ferrous from non-ferrous materials and iron contamination from liquids.

HI-POWR MAGNETIC AUTOMATION UNITS—to handle hundreds of materials-handling problems . . . to convey, control, transfer, elevate, re-position, etc., ferrous materials or parts during many manufacturing processes.

HI-VI VIBRATORY EQUIPMENT—to move and accurately feed bulk materials.

ERIEZ®

AUTOMATION

for the small manufacturer ... at a small capital cost

It's becoming more and more obvious that small and medium size plants must get into automated production if they're going to live through the price battle with larger, better equipped plants.

But too often small plant owners tend to shy away from "automation" because they believe large capital costs are involved.

Automation on a limited budget becomes practical when you think of automation not as an "automatic factory" but as a means of cutting costs on a lot of separate and often unrelated operations.

Automatic feeding of tools in such work as drilling, reaming, tapping, milling, forming, staking, etc.; automatic clamping and holding of work pieces; dial feeding of work pieces to tools; combining two or more operations on one machine with one operator instead of two; grouping and interlocking assembly operations for quicker parts handling and faster assembly—

These are practical automation steps which any manufacturer can take—with a minimum of invested capital—and a minimum of time.

Bellows Pneumatic Work Units Make it Relatively Easy

Bellows pneumatic work units (tool feeds, work feeders, work holding and clamping devices) are self-contained power units which can be quickly installed on practically any standard machine or machine tool. Air-powered, electrically actuated, and (if desirable) hydraulically controlled, they can be synchronized with the basic machine to perform automatically a wide range of functions. As packaged power units they can be readily combined with cataloged parts (switches, mounting plates or brackets, drill heads, etc.) to form inexpensive special purpose machines.

Your Bellows Field Engineer Can be of Real Help

Some 150 Bellows Field Engineers (one or more in each major industrial area) will work with your methods or tool engineers in adapting these low cost work units to your production line.

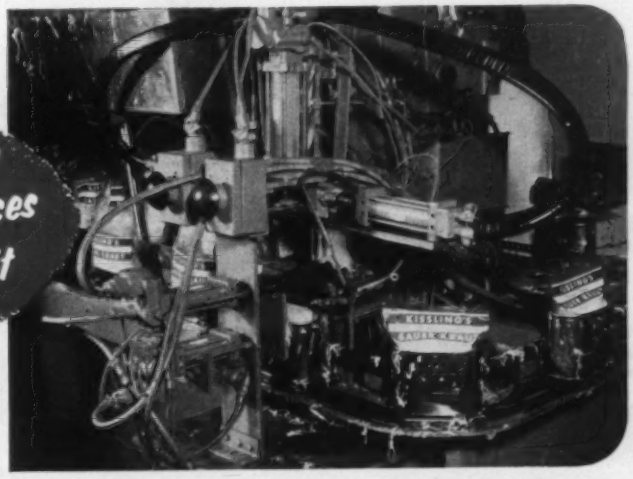
Take this step-NOW!

Let us send you, without cost or obligation, a collection of data on Automation particularly as it applies to the small or medium sized manufacturer. Included are reprints of articles in leading trade publications; typical case history stories showing how Bellows equipment is being used by manufacturers, and, of course, full information on the principal Bellows work units.

Write Dept. AU-1057, The Bellows Co., Akron 9, O. for the "AUTOMATION PORTFOLIO."

932-B

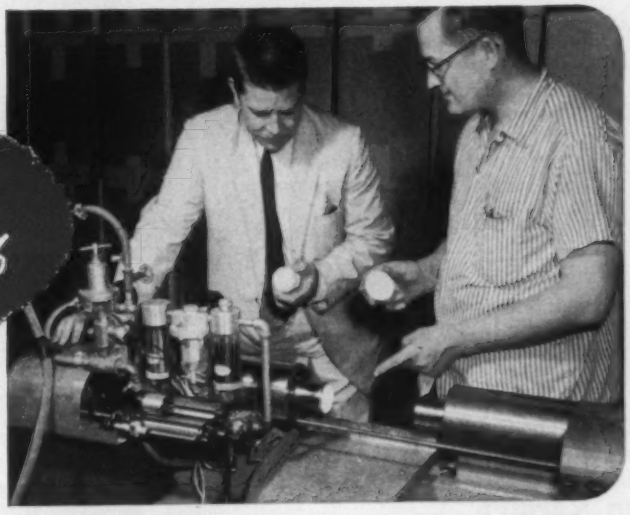
$5000 Shop-Made "Packager" Replaces $20,000 Unit



A. C. Kissling Co.
Philadelphia

Rejects from a $20,000 conventional machine for packaging sauerkraut were a consistent 17%. For a total cost of $5,000, a toolroom-built machine operated by nine electrically interlocked Bellows Air Motors, packages and seals 6300 packages in 8 hours . . . twice the production of the replaced unit. Rejects are a maximum 2%.

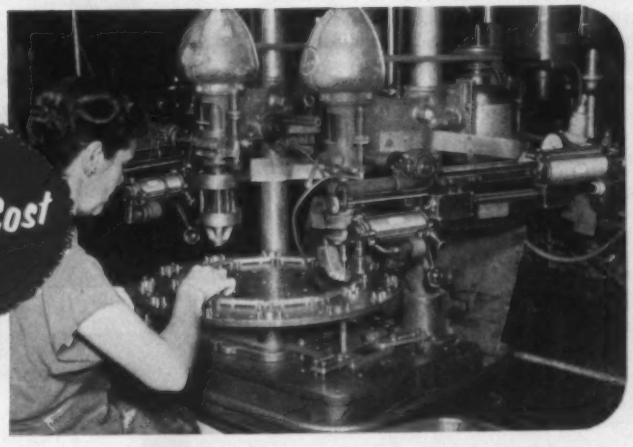
For $187.05 Unit Cost was Reduced 75%



The Brittain Products Co.
Cuyahoga Falls, O.

Spinning polyethelene shells to form a plastic ball was a hand-controlled operation producing 5 balls per minute . . . rejects were high, the operation was tiring. A Bellows Air Motor with hydraulic control, limit switches and an air filter . . . costing $187.05 . . . replaced the hand operated lever. Production is now 20 balls per minute: Same quantity of production is obtained in two hours as formerly obtained in eight hours, quality is uniform with very few spoiled parts.

Five Times Production... Half the Labor Cost



The Hedman Co.
Chicago

Hand drilling and tapping check protector parts required two skilled operators to produce 125 parts per hour . . . not enough to meet requirements. The two drill presses were then equipped with electrically controlled Bellows Drill Press Feeds, synchronized with a Rotary Feed Table to feed the parts to the spindles. The Bellows equipment cost $1,300. One operator now handles both the drilling and tapping operations. Production is 650 parts per hour.

The Bellows Co.
AKRON 9, OHIO

932-B

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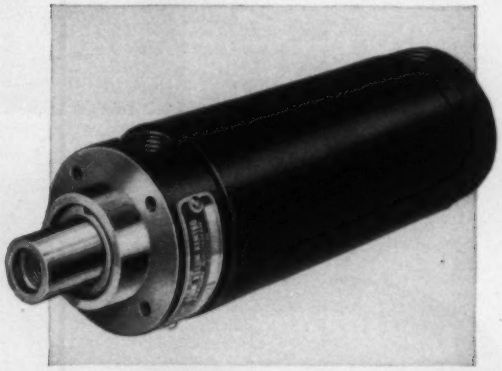
O-M

COMPACT IN DESIGN

KING SIZE IN PERFORMANCE

O-M Tie-Rodless Cylinder 150 psi Air Up to 1500 psi Oil



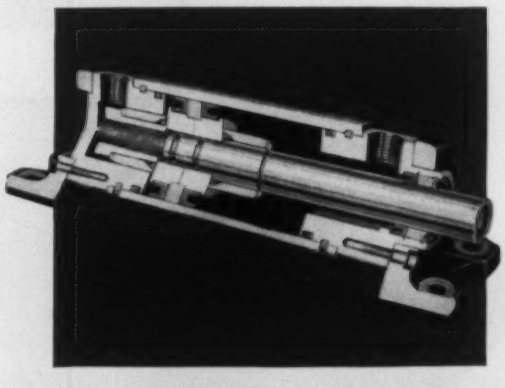
Here's the famous O-M Original Tie-Rodless Cylinder that takes one third less installation space than conventional tie-rod type yet packs plenty of power on both air or hydraulic circuits.

The result of modern research, design and engineering know-how, this powerful O-M component figures importantly in today's automation picture. Its high operating efficiency and ease of maintenance combine with its space-saving design and rugged construction to make it highly desirable in any application where its capacity meets specifications. Ports are easily oriented to any position.

O-M Air and Hydraulic Tie-Rodless Cylinders are available in a complete range of sizes (1½" to 8" bores) with standard or heavy duty rods. Completely interchangeable parts and mounts. Immedite delivery on many sizes.

Mail coupon now for Bulletins 101A (O-M Tie-Rodless Air and Hydraulic Cylinders) and 105 (O-M Series T-H Heavy duty Hydraulic Cylinders).

Meets JIC Standards



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Consult an Ortman-Miller representative regarding your pneumatic and hydraulic problems. His broad experience with standard and special cylinder applications is available to you without cost or obligation. Use convenient coupon for name and address of O-M representative nearest you.

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Fits Where Others Won't!

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AUTOMATION news

Today's events and developments in the field of automation

Impressive Bearing Plant Verifies Modern Concepts

PLANNING and operational details of Timken Roller Bearing's highly automated Bucyrus plant have recently been released for public inspection. The facilities which have been revealed are one of the more impressive automation installations in operation today.

Company officials describe their philosophy of automation as "the Bucyrus concept." Briefly, it embraces an active program of selling the customers on the advantages of standardizing their bearing applications to bearing sizes adapted to high production and the subsequent production of the standardized bearings at unprecendented production rates in as nearly an ideal industrial environment for employees as possible.

The plant is primarily responsible for the manufacture of cups and cones which are assembled with cages and rollers, supplied by other divisions, to form completed bearings. Eleven lines have been established to manufacture the cups and cones; 33 million cups and 27 million cones can be produced each year. At the present time, a total of 14 sizes of cups and cones (out of approximately 35 sizes) account for 80 per cent of the production volume.

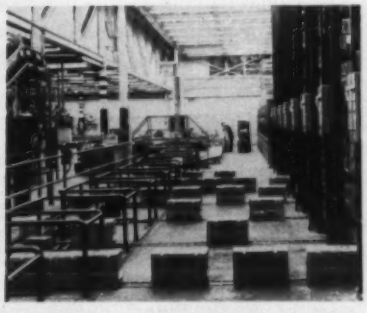
GENERAL view of the five cone lines in the Green Machining Department of the Bucyrus bearing plant of the Timken Roller Bearing Co. The plant has a production capacity of 33 million cups (outer races) and 27 million cones a year. Except for spot quality control checks, production is entirely automatic.

In planning for the new facility, Timken found that special machines and equipment would be required. The company financed the research and development of machine tools with the primary aim of developing smaller single purpose screw machines and grinding machines since the range of work to be performed was limited. The results are impressive. For example, with a special single spindle screw machine, equipped with carbide tooling, the plant now produces 8 times as many cups per hour as with an old model single spindle machine and 2½ times as many as a four spindle automatic.

In addition to metal cutting tools, a typical line contains various conveyors and chutes to transfer parts; orienting devices; banking equipment to maintain a steady flow of work; gaging equipment at all critical points; heat treating systems for carburizing and hardening; and assembly equipment and packaging machines.

The plant is equipped with a central hydraulic system for internal grinding machines, a central coolant system for all the grinding and screw machines, a central honing solution system and a central supply of high frequency power for internal grinding wheel spindles.

When the Bucyrus plant was originally started, only the plant manager and general superintendent had any experience in the manufacture of bearings. Part



IN BUCYRUS shipping center, chain conveyors mounted in floor move products from storage area to transfer station. Approximately 95 per cent of the company's products are handled in this one mechanized warehouse.

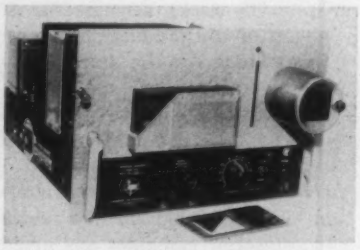
of the plan necessarily included a training program to train employees to operate the complex plant. Maintenance employees are trained with particular care in view of their importance to continued operations. Each maintenance man is qualified to handle millwright, machine repair, plumbing and to assist in electrical repair problems. Maintenance personnel participate in the incentive bonus plan as do all employees of the plant. The company has found it expedient to assign foremen to areas of the plant on a time basis. One foreman in the course of several years may have moved over the entire plant. Employees are similarly moved from department to department at intervals to combat boredom and monotony which might be associated with repetitious work.

In addition to the plant at Bucyrus, Timken has recently established a shipping center at the same location. This shipping center handles 95 per cent of the Timken company's bearing shipments—an operation in which over 10 million pieces are handled and shipped each month. The center is part of an integrated system of inventory control, production scheduling, storage and processing customer orders. An IBM 650 computer center in Canton, Ohio plays an important part in the overall inventory control system by maintaining current status of inventories in relation to production and customer demand. A future issue of AUTOMATION will cover the Bucyrus installation in detail.

Semiconductor Market Expands

ANNUAL sales of transistors and other semiconductors could reach $1 billion in the next ten years according to **James H. Sweeney,** manager of marketing for General Electric's semiconductor products dept. This year sales of semiconductors are now expected to exceed $140 million—an increase of 82 per cent over total semiconductor industry sales of $77 million in 1956. If the expected sales figure is reached it will also be 40 per cent over what most market analysts predicted last December for 1957 sales.

The early 1960's should see an expanding use of transistors as a result of price changes which make the components competitive with many electron tubes presently used. Industrial transistors are already the same price or lower than equivalent special purpose industrial tubes. Large scale mechanization of semiconductor manufacturing is the key to this progress.



PROGRAM scanner that operates from a photographic transparency of a curve drawn on graph paper has been developed by Spar Engineering & Development Inc. The unit can be used for various control, programing and computing applications. A scanning spot creates a vertical line which is moved horizontally across the transparency. The unit responds to the spot during the time it is below the curve by creating constant amplitude, variable width pulses for the voltage output in providing the control signal.

UNIQUE universal transfer device that simulates most of the motions of a human arm, wrist and hand has been engineered by the Planet Corp. The unit was conceived in answer to an automotive producer's need for handling hot castings from a die casting machine through a water quench and into a press die for trimming. The device can perform a total of 25 individual movements during any one cycle or sequence. Hydraulically operated, it is controlled by an electronic sequencing unit that can be programed by a plug board arrangement or controlled by an operator.

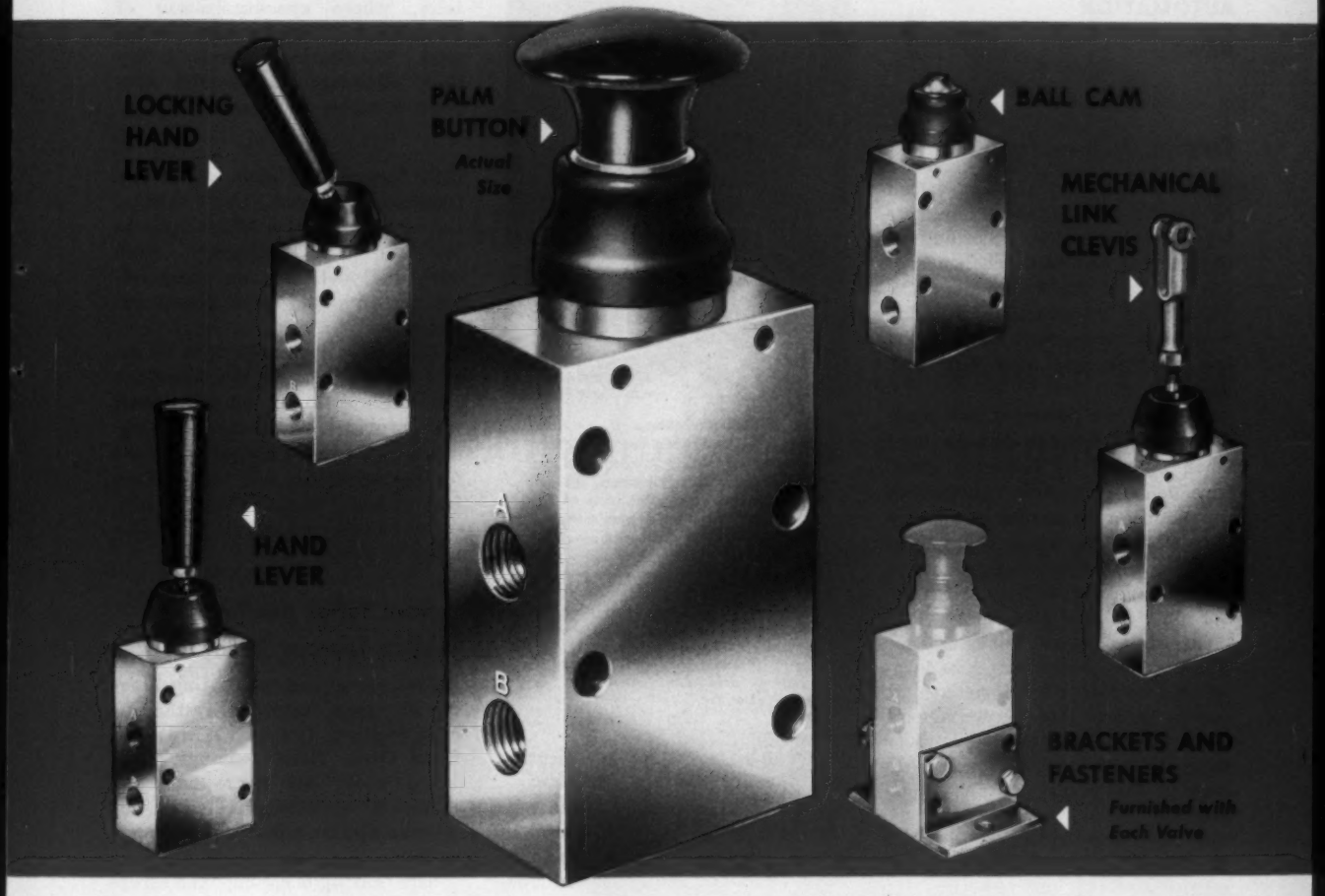
Extended Financing Available

TIME-sales financing program offered by Pratt & Whitney Co. Inc. in co-operation with C.I.T. Corp. has been broadened. The program now includes a depreciation-geared plan with terms to 10 years and down payment requirement as low as 10 per cent.

Edward P. Gillane, president of Pratt & Whitney who worked closely with C.I.T in creating the new program, indicated that there has been a growing demand in marketing in machinery sales for broader financing arrangement. He stated, "increasing tightness in the money market has resulted in the need of many machine tool users for greater flexibility in financing major purchases."

BOARDS of Directors of Eagle Signal Corp. and its subsidiary, Hagen Mfg. Co. Inc., have elected **Ernest R. Freeberg,** president and general manager of the two companies. Freeberg was chief engineer of Eagle Signal during the time that the company developed its line of industrial timers, aircraft timers and traffic control equipment.

NEW HANNA FLO-PILOT VALVE has dirt-proof seal!



Hanna Flo-Pilot Valves are ¼" two- and three-way Pilot Valves for air operation to 150 psi. They are used for remote control of master valves, directional control of small single acting cylinders and for shut-off. Same valve can be used for two or three-way operation either normally open or normally closed to inlet pressure.

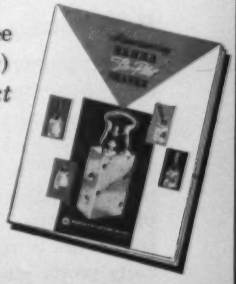
HANNA Flo-Pilot Valves will deliver years of dependable performance at a very low cost because they have built-in money-saving features. Every Hanna Flo-Pilot Valve is equipped with a synthetic boot which seals the valve stem and internal parts from harmful dirt and abrasive, thereby eliminating the most common cause of valve failure.

These protective boots, efficient "O" ring spool packing and nylon sleeves, are built into every Hanna Flo-Pilot Valve to save you money and assure leak-free operation even after millions of cycles.

The five actuating-heads—push button, ball cam, hand lever, locking hand lever and mechanical link clevis—are interchangeable in a matter of seconds. Spools can be changed just as quickly without disturbing the piping.

Corrosion resistant materials are used throughout. Flo-Pilot Valves have a simple, sturdy construction with anodized aluminum body, stainless steel and molded nylon parts. Valves can be conveniently mounted in any position and are furnished with brackets and fasteners. They are easy to operate, positive acting and have full capacity of ¼" orifices.

Ask your Hanna representative (see the yellow pages or Thomas Register) for complete information or *write direct for Catalog 262.*



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Ceramic Magnets for DC Motors

CERAMIC permanent magnets can be used in place of electromagnets for dc motor fields, according to engineering and research heads of The Indiana Steel Products Co. The recent introduction of Indox V ceramic permanent magnets by Indiana Steel has made this possible.

Because the powerful new magnets will not become demagnetized when opposed by powerful armature fields, it is now practical to use them for dc motors of all sizes —from tiny fractional horsepower motors, to large multiple horsepower machines of 10 hp and more.

From a manufacturing viewpoint, this means that ceramic magnets can save cost. The larger the motor, the more cost is saved, because the percentage of total cost represented by these magnetic materials decreases with size of the magnets. The Indox magnets use no critical materials, and they are lighter than usual permanent magnets or electromagnets.

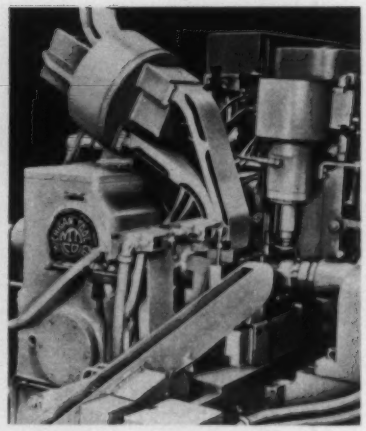
Other advantages accrue from the use of permanent magnets in place of the copper wound electromagnets for dc motor fields: Higher efficiency, cooler operation, simplified motor design and lower fabricating cost.

It was also pointed out that permanent magnet fields can match virtually all elemtromagnetic fields in terms of size or total volume, except in cases where wound field motors are designed to operate with high short-time overloads, as in electric starter motors.

Electronically Controlled Pumps

INTRODUCTION of electronic controls to the company's line of variable volume pumps has been announced by Racine Hydraulics & Machinery Inc. Electronic pickups that will sense the power needs of mechanized equipment and activate the pumps which hydraulically power such machinery are to open a whole new field for Racine Hydraulics, according to executive vice president **John E. Erskine.**

It is anticipated that these controls will be particularly useful in serving the machine tool and material handling equipment industries, where synchronization of mechanical processes has become vital. The electronic elements, further, eliminate complicated systems of piping in present usage.



FOR back-to-back hobbing, a new automatic parts feeder has been introduced by Michigan Tool Co. Although designed primarily for Michigan hobbers, the unit can be used to load other types of machine tools. Similarly aligned parts are gravity fed into the drum type alternator mounted on the hobber. A rotating arm in the drum reverses every other part and introduces the workpieces into independent feeder tracks. The tracks merge at the input to the machine, where the two parts are positioned back to back. This permits a form of hobbing which, besides increasing production, substantially reduces hob wear.

TEN former staff members of the Dynamic Analysis and Control Laboratory of the Massachusetts Institute of Technology have formed Hydel Inc., an independent research and development organization.

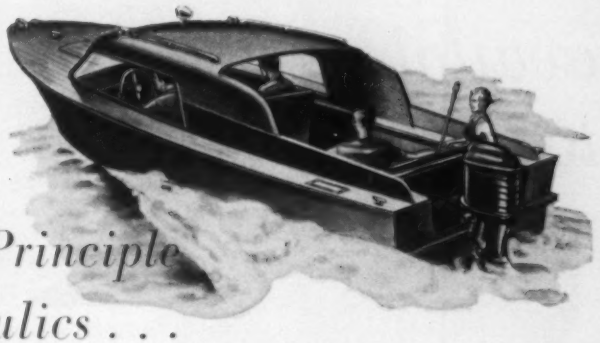
The new corporation is to be assisted financially by the American Brake Shoe Co. in an agreement that provides added initial working capital and business guidance for the scientists, but leaves them free to serve industry in the field of automatic control as an independent group.

Bonded Teflon Bearing Exhibits Superior Qualities

NEW type of self-lubricating bearing has been developed by the Micro-Precision Div. of Micromatic Hone Corp. These bearings, marketed under the trade name of "Fabroid" have been tested on numerous airplane and missile applications.

The bearing is a composite struc-

USE of a new Leeds & Northrup automatic load control system has saved Allegheny Ludlum Steel Corp. a reported $4,750 during the first month of operation. The load control system integrates the kw hours excess over a desired demand period and automatically determines if a load reduction is required to control peak demand. If a reduction in peak load is indicated, the control selects the furnaces which are melting and regulates these particular furnaces without disturbing the furnaces in the plant that are contributing only slightly to excess demand.



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The outboard motor is popular because it is a complete, self contained power package . . . quick and easy to apply.

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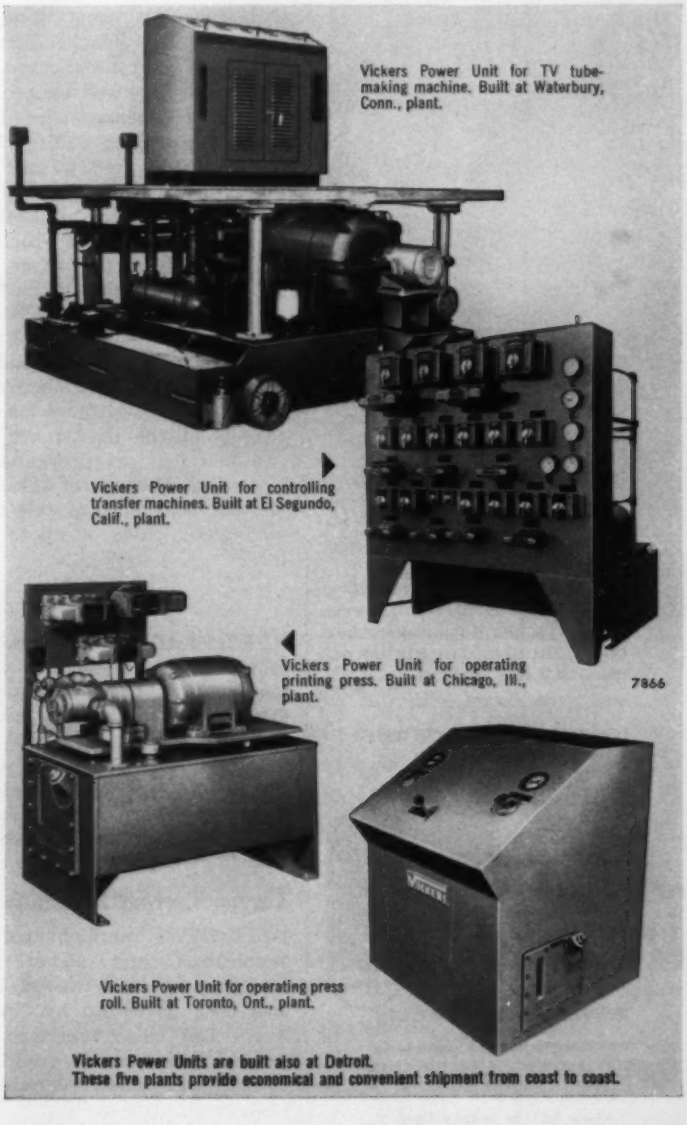
All necessary pumps, valves, intermediate piping, motors, controls, oil reservoir, oil filters, air cleaners, oil level gauges, fittings, etc. are included, as well as electronic components if used.

You are assured dependable performance. Design is improved and simplified, time and cost of installation are reduced, appearance is better, servicing is easy. Each unit is pretested at the factory and is ready for immediate operation. Vickers undivided responsibility for the entire hydraulic control system is important to both the machine builder and his customer. Write for Bulletin 52-45.



Vickers Power Unit for TV tube-making machine. Built at Waterbury, Conn., plant.

Vickers Power Unit for controlling transfer machines. Built at El Segundo, Calif., plant.

Vickers Power Unit for operating printing press. Built at Chicago, Ill., plant.

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Vickers Power Unit for operating press roll. Built at Toronto, Ont., plant.

Vickers Power Units are built also at Detroit. These five plants provide economical and convenient shipment from coast to coast.

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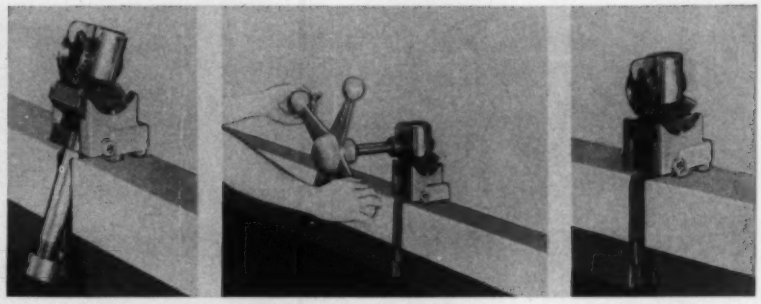

IMPROVED method of fixing dies to press slides has been developed by Clearing Machine Corp. The mechanical punch clamps can be permanently mounted to the slide flange of a press. As shown, a swinging T-bolt fits through an open slot in the slide flange to engage a recess or pocket in the die. A rotating hand wheel can be used to tighten the clamp; when the hand wheel is withdrawn, a spring-loaded locking pawl drops into a locking position to prevent accidental loosening of the clamp.

ture consisting of two fused layers. The bearing face is a weave of Teflon interwoven on the back with glass fibers impregnated with thermosetting phenolic. These two layers are bonded and cured at elevated pressures and temperatures, resulting in a dense lattice of fibers facing the bearing surface and intimately supported by the interlinked glass-phenolic structure.

When subjected to loads, the bearing has properties which differ materially from any other known use of Teflon plastic, essentially because each strand of Teflon is completely surrounded by a supporting structure. Under load, when intimate contact exists between the two bearing surfaces, separate strands of the plastic are locked and therefore are prevented from extruding. Because of this principle, the bearings are able to support static loads of up to 60,000 psi.

APPOINTMENT of **Kenneth H. Meyer** to post of director of engineering has been announced by C. B. Hunt & Son Inc., manufacturer of pneumatic and hydraulic control valves. In moving up from his previous position as assistant chief engineer, Meyer succeeds **C. S. Chessman** who has resigned.

Carrier Current Switching

SELECTIVE multichannel communication and signal system which operates on carrier current has been developed by Nutronics Inc. The basic function of the system is to provide private communications between various buildings and offices without the need of interconnecting wires. Experiments indicate the possibility of expanding the present 12-station model which provides 11 independent selective channels to an increased capacity of 540 positions.

The system can be adapted for remote control signaling applications that presently requires extensive cabling. The selective feature insures that only a called station responds to a signal, preventing interference or eavesdropping by other stations within the circuit.

Measuring Instrument Survey

DEPARTMENT of Commerce's Business and Defense Services Administration is in the midst of an important study of measuring instruments. An attempt is being made to classify measuring instruments on the basis of their particular actuating mechanisms, rather than in terms of their functions. Valuable for defense purposes, a classification according to generic structural characteristics serves the purpose of identifying the instrument with the nature of the production facilities that are necessary to its manufacture. A detailed breakdown into further classes, such as precision, etc. will relate the instrument mechanisms to the type of machinery, tooling and skills essential to their production.

Companies which receive a questionnaire related to this study are urged to give the Business and Defense Services Administration their co-operation in a project vital to defense mobilization activities.

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"We grind no axe . . . and really have no need to." After all, Bliss makes so many types and sizes of metalworking presses—actually many more than any other builder—that we favor only the one right press for your job. It may be a big one, a little one, a mechanical, a hydraulic, a standard or a special. But you can be sure it will be the *right* one.

If you have a pressed metal problem, isn't it logical to talk to a source that's certain to give you an impartial answer? To talk to Bliss?

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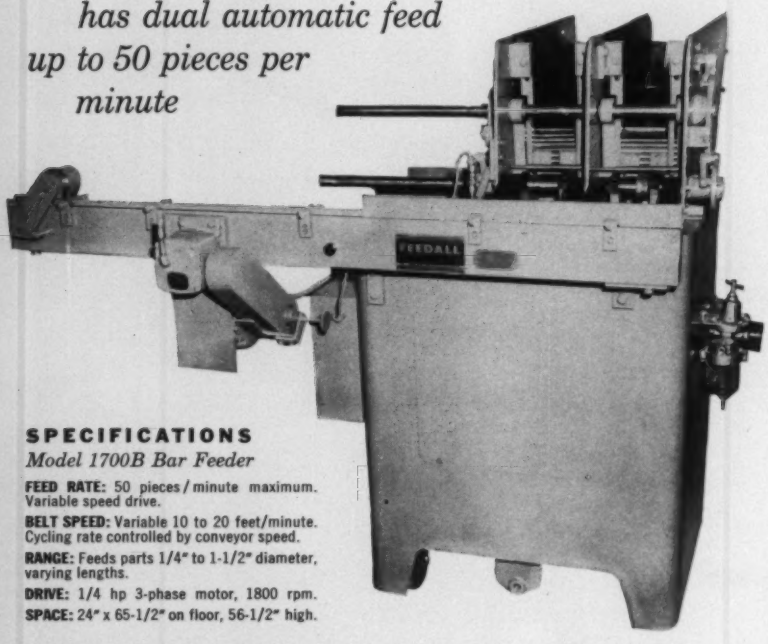
NEW AUTOMATIC

Feedall

BAR FEEDER

has dual automatic feed up to 50 pieces per minute



SPECIFICATIONS

Model 1700B Bar Feeder

FEED RATE: 50 pieces / minute maximum. Variable speed drive.

BELT SPEED: Variable 10 to 20 feet/minute. Cycling rate controlled by conveyor speed.

RANGE: Feeds parts 1/4" to 1-1/2" diameter, varying lengths.

DRIVE: 1/4 hp 3-phase motor, 1800 rpm.

SPACE: 24" x 65-1/2" on floor, 56-1/2" high.

Eliminates costly hand-feed with fast automatic production operation

The **high-speed output** of the Feedall 1700B means twice as many pieces fed per hour . . . **less cost** per unit . . . **larger** production capacity . . . **steady flow** of bars and tubing onto a conveyor belt at desired rate (cycling rate controlled by variable speed drive on belt) . . . full automatic operation of parts production machines and processes.

The secret is the unique double feed, which provides twice the capacity and twice the cost-saving of comparable single feeders. When installed on centerless grinders, polishing machines and heat-treat equipment, the 1700B handles a wide range of parts lengths, diameters and feed rates. And operating reliability is unsurpassed.

There's extra economy, too, in the simple "complete-package" design. The unit is self-contained, occupies only minimum floor space.

The all-important details of cost-saving automatic feed with Feedall machines are presented in the latest catalog, complete with estimate data sheet. Write for your copy . . . or send us sample parts you want to feed and include brief data. We'll do the rest, promptly.

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Circuit Boards Sensitive To Environment Changes

CHANGES of electrical resistance in printed wire boards made of certain materials can result very quickly from large temperature or humidity variations, according to **John Spalding,** a physicist in General Electric Co.'s Light Military Electronic Equipment Dept.

Study of the problems of humidity and temperature effects on printed wiring was started, to find out why some boards failed under certain circumstances. Spalding indicated that his investigations turned up some facts that were not fully realized before, such as a definite change in resistance from temperature variations alone. He said that the results of the study can be applied as a yardstick to determine the precise limits within which circuits must be designed for maximum reliability, particularly for airborne military electronic equipment. The study showed that alterations in surface humidity and temperature of printed boards can change the resistance between wires by a factor of 10,000 in a matter of minutes. This means a resistance of 10,000 megohms could become only 1 megohm and result in failure of a component if the operating conditions weren't taken into account in the circuit's design.

EXPANSION of Thor Power Tool Co. through the acquisiton of Drying Systems Inc. has been announced by **N. C. Hurley Jr.,** president of Thor. Drying Systems engineers, produces and installs all types of air conditioning and heat processing equipment and controls for industries ranging from automobile manufacturers to food processors. **B. B. Russell,** president, continues at the helm of Drying Systems as it becomes the Drying Systems Div., Thor Power Tool Co.

Automatic Precipitator Control Gives Optimum Performance

COLLECTION efficiency for an installation of electrostatic precipitators is dependent upon maintenance of the maximum voltage and current as limited by an allow-

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For your convenience, advertisements and items of information on new equipment, components and manufacturers' literature can be quickly identified by an *Item Number* accompanying each unit.

For additional free information circle item number on an inquiry card. Fill in your name, title, address, etc.—Drop it in the mail—No Postage Required—Your request will receive prompt attention and will be filled directly by the manufacturer.

So that you won't have to clip this issue, we will gladly send you a personal copy of any article. Just fill in the page number and title of the article you desire.

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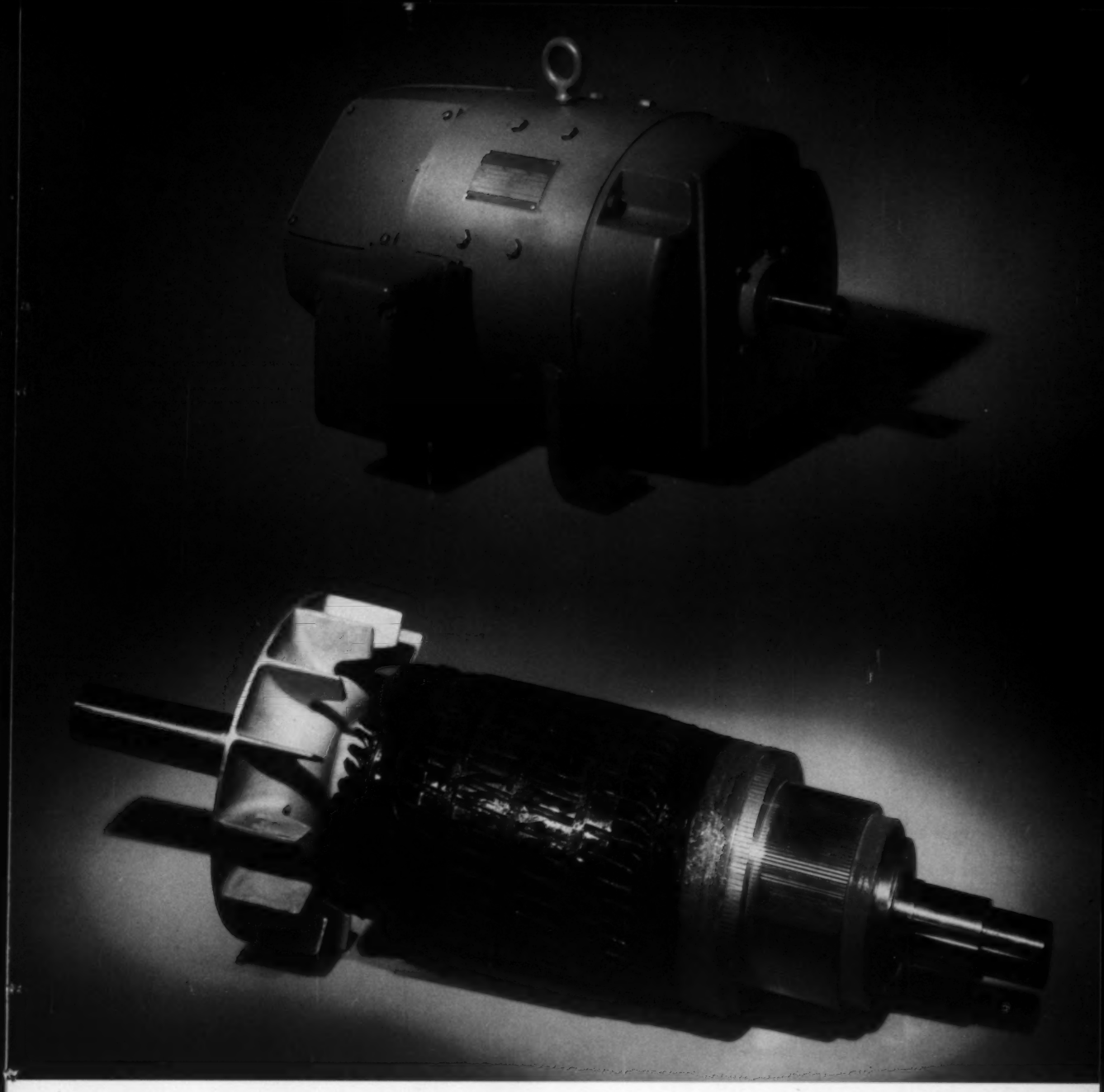


NEW GENERAL ELECTRIC DC MOTOR GIVES

Instant Working Power

KINAMATIC* . . . a new standard in industrial direct current motors . . . designed to deliver drive power at the moment you need it!

Split-Second Response . . . larger air gaps reduce electrical time constants . . . smaller armature diameter permits more rapid delivery of torque to load . . . means faster starts, stops, reversals.

Low Inertia Armature is dynamically balanced, banded with steel and glass . . . gives dependable, high-speed operation . . . skewed armature slots minimize torque pulsation, permit smooth machine operation at low speed.

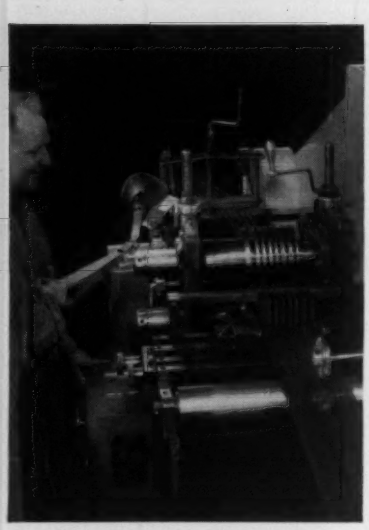
Other Power Packed Features of new d-c Kinamatic motors help give you more continuous, more automatic production . . . economically.

Additional information is available at your nearest General Electric Apparatus Sales Office. Or, if you prefer, write for Bulletin GEA-6355. *Direct Current Motor and Generator Department, Erie, Pennsylvania.* 813-9

*Trade-Mark of General Electric Company.

Progress Is Our Most Important Product

GENERAL ELECTRIC



YODER SLITTERS Supply Varied Strip Widths for Tinnerman *Speed Nuts*®

Tinnerman Products, Inc., Cleveland, Ohio, produces more than 10,000 different shapes and sizes of "SPEED NUT" brand fasteners for industry . . . many of them to special specifications.

To do this, Tinnerman uses slit steel strands ranging in width from ⅛" to 7½". To carry an inventory of the many strip widths required to meet normal and unusual demands would be almost impossible.

Tinnerman overcomes these inventory and supply problems by doing their own slitting on two Yoder slitters. This enables them to supply the plant with any strip size required from a relatively small inventory of 6" and 9" width purchased coils. In slitting narrow strands, such as these from small coils, a Yoder slitter may be profitable on a production as low as 25 tons per month.

Here is a fine example of how a small investment in Yoder slitting equipment greatly simplifies and speeds production while effecting important operating economies.

The saving made in time alone, reflects in better customer service through faster completion and delivery of finished products.

If your steel strip or sheet slitting requirements are as low as 100 tons per month or even less, a medium size Yoder slitter can be a very profitable investment for you. The Yoder line includes units of every size and capacity . . . of the most advanced engineering design. Send for the Yoder Slitter Book —a comprehensive text on the mechanics and economics of slitters and slitting line operation, with time studies, cost analyses and other valuable data. Write to:

THE YODER COMPANY
5526 Walworth Avenue • Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING **ROTARY SLITTING LINES**

Circle 665 on Inquiry Card

able sparking rate. Usually this will be from 50 to 100 sparks a minute. However, the power input at which the allowable sparking rate is reached depends upon operating conditions that may be undergoing constant change. Such conditions are gas temperature, composition, rate of flow, or humidity, as well as dust size, resistivity, and build-up on electrodes.

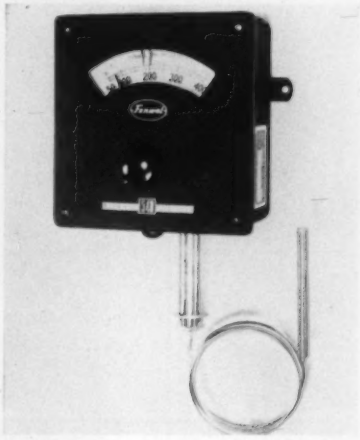
To replace the operator that is normally required to obtain optimum operation by manual adjustment of controls, Research-Cottrell Inc. has introduced a system containing continuously acting electronic feedback circuits which monitor the sparking rate and adjust the power input to maintain sparking at the predetermined rate that assures optimum collection efficiency. No supervision is necessary, other than the initial action of turning the remote control switch that puts the precipitator into operation. The unit compares actual current, voltage, and sparking conditions in the precipitator with an ideal preset reference level determined by experimentation with both the precipitator and the process for a given installation.

ORGANIZATION of the Denison Research Foundation, a not-for-profit Ohio Corp., has been announced by **W. C. Denison.** The organization will serve industry and the U.S. Government by providing research talent and facilities for conducting a wide variety of research. Initial emphasis will be on projects in the electronic, mechanical, metallurgical, ceramic and management fields.

Versatile Telemetering System

DIGITAL data transmission is possible with remote control telemetering system introduced by Pacific Div. of Bendix Aviation Corp. The systems will perform on commonly used communication channels such as telegraph circuits, telephone lines, VHF radio or micowave links. Standard plug-in assemblies are combined to perform specific tasks which a user may require. Available assemblies include digital pressure gages for the measuring and indication of pressure; tank gage transmitters for transmission of temperature and level information; shaft position controllers; and various read-out devices ranging from typewriters to lamp systems. Two basic types of system are available; a simultaneous code system utilizing voice band width and a sequential pulse code system using telegraph circuits.

Examples of installations where the system has demonstrated its reliability are: Water pipe line control data transmitting system for the Air Forces, weather observation center, and drone vehicle control.



MAJOR elements of line of bulb and capillary temperature controllers produced by Fenwal Inc., Ashland, Mass. can be readily changed and offer users a wide choice of controllers. The following elements are available in several variations or ratings: Switching and indicating mechanism, switch type, temperature range, housing, bulb diameter, capillary length and materials of construction. For example, the user has a choice of four control mechanisms which vary in the number of circuits that can be controlled and in the adjustment and indication of temperature set point. The model shown has two control switches, each with a set point indicator; bulb temperature is indicated by the pointer on the lower half of the dial. The operating temperature differential between the two switches can be adjusted from a maximum of about one-half the scale range down to about 1F under optimum conditions.

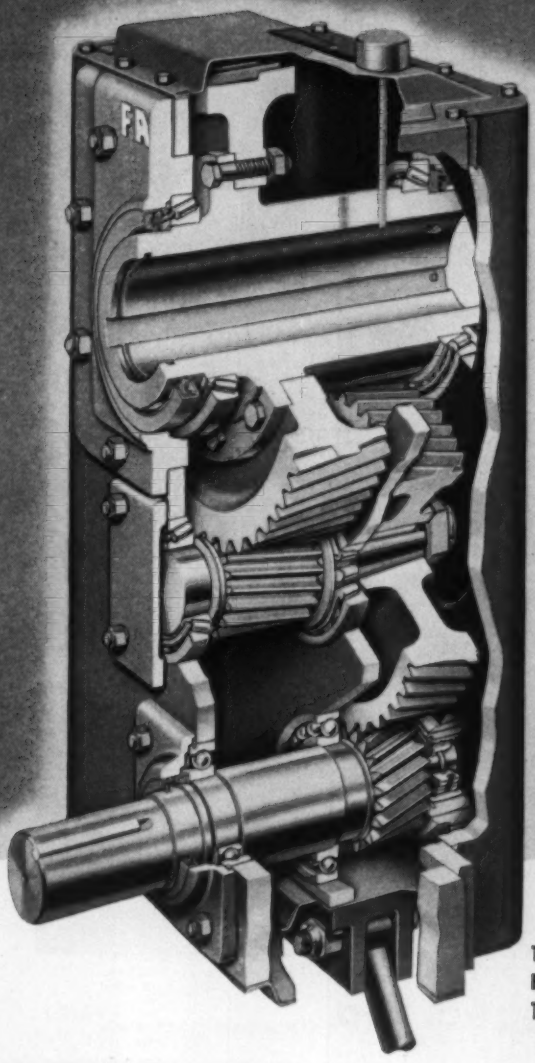
Alarm Device Monitors Moisture Build-up In Lines

INCREASED range of uses of pneumatic-operated control instrumentation in industry increases

New...LARGER...ALL-STEEL!

-the FALK 315J Shaft Mounted Drive

- **for higher horsepower**
- **for lower output speeds**



THE NEW 315J...
FROM 2 HP AT 5 RPM
TO 50 HP AT 359 RPM

Check These Features

New — 3-wall, one-piece housing provides double the ability of cast iron to withstand external impact or shock loads.

New — ratio range—5:1, 14:1 or 25:1. Higher ratio range makes possible lower output speeds...smaller sheaves...standard, rather than slow-speed, motor.

New — ease of maintenance. All revolving elements can be easily replaced in the field, on the jobsite! Inspection covers permit quick inspection of gears and bearings. Dipstick provides quick check on lubricant.

New — longer center distance between shafts allows use of larger sheave on input shaft. Unit may be mounted with input shaft next to driven machine, and with motor mounted directly under driven shaft.

PROMPT DELIVERY

Standard units are available for off-the-shelf shipment from factory, warehouse or distributor stock.

LET US HELP YOU

Your Falk Representative or Authorized Falk Distributor will gladly review your applications and offer suggested selections—without obligation.

Write for Bulletin 7100

The new Falk 315J also gives you these famous Falk advantages—

- Falk extra-depth, extra-capacity gear teeth—plus the extra efficiency (98½% per gear mesh) of helical gears for maximum power utilization.
- Through-hollow shaft design for easy installation, with internal groove to permit use of bearing puller when dismounting unit. Hollow shaft also permits use of unit on through-shaft applications.
- Tie rod fastened to steel housing by steel bracket with bolt in double shear. Shock load on tie rod will not damage housing.

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

Representatives and Distributors in Most Principal Cities

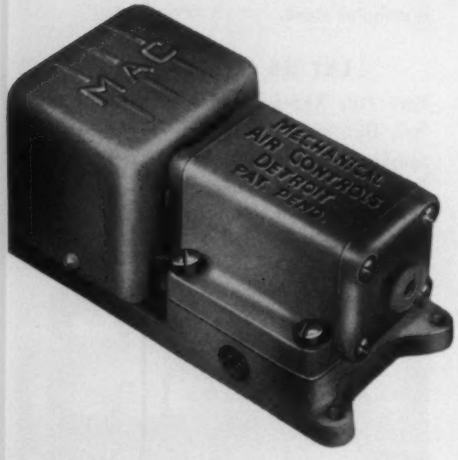
Manufacturers of Quality Gear Drives and Flexible Shaft Couplings

Circle 666 on Inquiry Card

FALK

...a good name in industry

Precise, yet rugged, too



Like Old Reliable here, MAC valves are proved performers. They're designed for dependability . . . precision built to operate *exactly*—cycle after cycle. That's because we demand much more from our valves than just ordinary duty. MAC spools, for instance, are engineered to withstand at least 75 times actual use load. MAC springs are "shot-peened"—a process that lengthens life by more than 1000% and virtually eliminates spring failure.

So it goes—*right down through the assembly line.* We build in the important "extras" that make the difference. And that's why you can expect more from a MAC valve—in performance, dependability and long life. Contact a representative listed at right. His know-how can help you with any air valve application.

MECHANICAL AIR CONTROLS, INC.
10030 Capital, Oak Park, Detroit 37, Michigan

MAC

Circle 667 on Inquiry Card

PHONE YOUR NEARBY "MAC" REPRESENTATIVE FOR DATA AND DELIVERY

ARKANSAS
Branch-Merwin Tool Specialists, 447 N. Bellevue, Memphis, Tenn., BRoadway 8-6102

CALIFORNIA
OAKLAND 8—The Rucker Co., 4700 San Pablo Ave., OLympic 3-5221
SOUTH GATE—The Rucker Co., 4956 Firestone Blvd., LOrain 4-2521

FLORIDA
MIAMI SPRINGS—Aero Hardware & Supply Co., 4301 Northwest 36th St., TUxedo 8-2414

ILLINOIS
CHICAGO 43—Mike C. Modrich Co., 10918 South Western Ave., HIlltop 5-3640

INDIANA
EVANSVILLE—Neff Engineering Co., 2509 Washington Ave., GReenleaf 7-4141
FORT WAYNE 3—Neff Engineering Co., P.O. Box 2001, Station A, 2339 Crescent Ave., EAstbrook 7391
INDIANAPOLIS 20—Neff Engineering Co., P.O. Box 7361, 42nd St. Station, CLifford 5-5418
SOUTH BEND 15—Neff Engineering Co., 103 South Varsity Dr., CEntral 2-3800

MASSACHUSETTS (and New England)
BOSTON 34—Electrical Apparatus Co., Inc., 1200 Soldiers Field Rd., STadium 2-7440

MICHIGAN
BAY CITY—Fred Kober, 506 Chilson St., TWinbrook 2-2629
FLINT 2—Kober Sales Engineering Co., 1115 Root St., CEdar 2-7165
WESTERN MICHIGAN—Everett Adams, 17212 Sharon Road, Chesaning, Michigan, Victor 5-3446

MINNESOTA
MINNEAPOLIS 4—Air Engineering & Supply Co., 2445 Nicollet Ave., FEderal 9-5579
MINNEAPOLIS 3—Air and Hydraulic Equipment Co., 15 E. 38th St., TAylor 3-6118
ST. PAUL 14—W. H. Schulz Co., 2438 Franklin Ave., MIdway 4-2791

MISSISSIPPI
Branch-Merwin Tool Specialists, 447 N. Bellevue, Memphis, Tenn., BRoadway 8-6102

MISSOURI
ST. LOUIS COUNTY—Oscar E. Jost Co., P. O. Box 6, St. Ann, HArrison 8-4488

NEW YORK
BUFFALO 26—C. H. Tepas Co., 200 Washington Hwy., CIrcle 3210

OHIO
CINCINNATI—The R. W. Nichols Co., Fidelity Federal Savings Bldg., 2087-9 Sherman Ave., Norwood, ELmhurst 1-2440
DAYTON—The R. W. Nichols Co., 407 Realty Bldg., MIchigan 4724
OLMSTED FALLS—The R. W. Nichols Co., P. O. Box 6, ADams 5-3366
TOLEDO 4—The R. W. Nichols Co., 510 Manhattan Building, CHerry 1-1447

OREGON
PORTLAND—The Rucker Co., 911 N. W. Hoyt St., CApitol 3-0205

PENNSYLVANIA
PITTSBURGH 22—The R. W. Nichols Co., 101 Investment Bldg., ATlantic 1-6050
PHILADELPHIA 41—Automation Aides, 4817 Old York Rd., MIchigan 4-0807

TENNESSEE
MEMPHIS—Branch-Merwin Tool Specialists, 447 N. Bellevue, BRoadway 8-6102

TEXAS
DALLAS 35—Womack Machine Supply Co., 2010 Shea Rd., FLeetwood 7-3871

WASHINGTON
SEATTLE—The Rucker Co., 1000 4th Ave., South, MAin 2783

WISCONSIN
MILWAUKEE 17—Neff Engineering Co., 5856 N. Pt. Washington Rd., EDgewood 2-1579

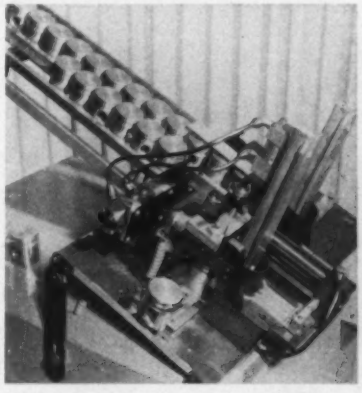
CANADA
TORONTO—Trevor Babbs, Agincourt, Ontario OXford 1-4857

MECHANICAL AIR CONTROLS, INC.
DETROIT 37, MICHIGAN
MAC

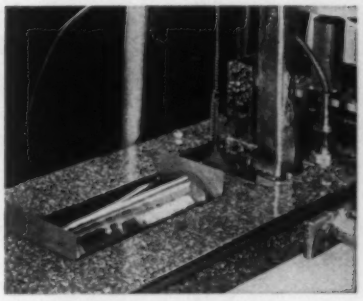
the interest in detecting unfavorable moisture build-up in air lines. The American Instrument Co. has developed a dew-point monitor system which detects unfavorable moisture build-up and actuates an alarm.

The system is comprised of two devices: a precise humidity controller containing a sensitive electronic switch that actuates the alarm when a preset dew-point temperature is exceeded and a small plug-in type electric hygrometer sensing element which signals the humidity controller. The sensing element is directly installed within the pneumatic system by means of a threaded mounting, eliminating the need for sampling in order to monitor dew-point temperatures. The controller may be set to actuate an alarm for dew-point temperatures as low as −45 F at 50 psi and −60 F at 150 psi. The equipment may be safely used in pressure systems up to 1000 psi.

DESCRIPTIVE literature which describes automatic and semi-automatic strapping machines is available from A. J. Gerrard & Co. according to **D. F. Downing**, executive vice president. The machines which are described will apply flat steel band, oval and round wire, and glass filament reinforced pressure sensitive tape.



SPECIAL PURPOSE production machine for assembling oil and compression rings to pistons designed and built by Automation for Industry, Port Crane, N. Y. for Carrier Corp. Power for all movement is furnished by a 30 psi air supply. Special type flow control valves are built into each cylinder to synchronize and control the complete machine. Overall result is increased production, reduced ring breakage and reduction of operator fatigue.



SOLDERING UNIT designed to reduce the difficulties and problems involved in conventional flat dip-soldering of printed circuits. This Flowsolder unit of Electrovert Inc., New York, brings molten solder up to the circuit instead of the circuit being lowered into the molten solder. An impeller pump creates a stationary wave by forcing the solder through an elongated nozzle. The circuit panel is passed through the crest of this wave of molten solder and joints between component leads and copper conductors on the underside of the panel are electrically connected.

Space and Cost Savings Follow Organization of Inventory

EXTENSIVE live storage rack system, engineered and built by Alvey-Ferguson Co., has been installed by Crown Cotton Mills. The system automatically provides first-in first-out control of stored yarn—important because dyed lots must be kept together in order until final shipping.

The live storage racks consist of many units of gravity roller conveyor mounted in an adjustable frame. These 60-ft long conveyor lanes are sloped so that packages of yarn move freely by gravity to the front of the rack. While storage systems often are made using skate-wheel conveyor, roller conveyor was used here because of the weight, bulk, and softness of the carton.

Unique handling devices load and remove cartons on opposite sides of the rack. These consist of elevators or vertical lifts which traverse the face of the rack on rails, permitting quick mechanical access to each storage lane. This system made possible building the rack almost to the ceiling, making optimum use of the storage space.

RECENTLY associated with Fischer & Porter Co. as vice president and general manager of the Data Reduction and Automation Div., **Robert K. Stern** has been ap-

GREENLEE TRANSFER MACHINES

Change with Your Requirements

THIS MACHINE HAS BEEN REWORKED FOUR TIMES

The "building block" idea of machine tool design has gained much popularity in recent years. Greenlee has long built such flexibility into their transfer machines. For example, the machine shown here has been modified 4 times in 11 years to accommodate changes in product design. Protect yourself from costly obsolescence. Ask Greenlee to show you how.

PHONE ROCKFORD, ILLINOIS 3-4881
TO HELP SOLVE YOUR PRODUCTION PROBLEMS

GREENLEE
BROS. & CO.

2090 MASON AVE.
ROCKFORD, ILLINOIS

Circle 668 on Inquiry Card

pointed president of Mid-Century Instrumatic Corp. The reorganized corporation has undertaken an ambitious program aimed at broadening the market for analog computers through technological missionary campaigns in fields not yet familiar with the possibilities of analog computer application.

In discussing plans for the future, Stern stated, "Mid-Century Instrumatic Corp.'s research and development program will be directed towards producing and marketing equipment which adds programing techniques previously used only in digital machines. We also plan the sale of auxiliary equipment which can be used with existing computers for modernizing control and programing."

MEETINGS AND EVENTS

Oct. 7-9—

Second Conference on Manufacturing Automation. Co-sponsored by Purdue University and AUTOMATION Magazine, to be held Purdue University, West Lafayette, Ind. For information contact the Editor, AUTOMATION, Penton Bldg., Cleveland 13, O.

Oct. 14-15—

Fourth Conference on Mechanisms to be held at Purdue University, West Lafayette, Ind. Sponsors are the Purdue School of Mechanical Engineering and *Machine Design*. Additional information can be obtained from the Editor, *Machine Design*, Penton Bldg., Cleveland 13, O.

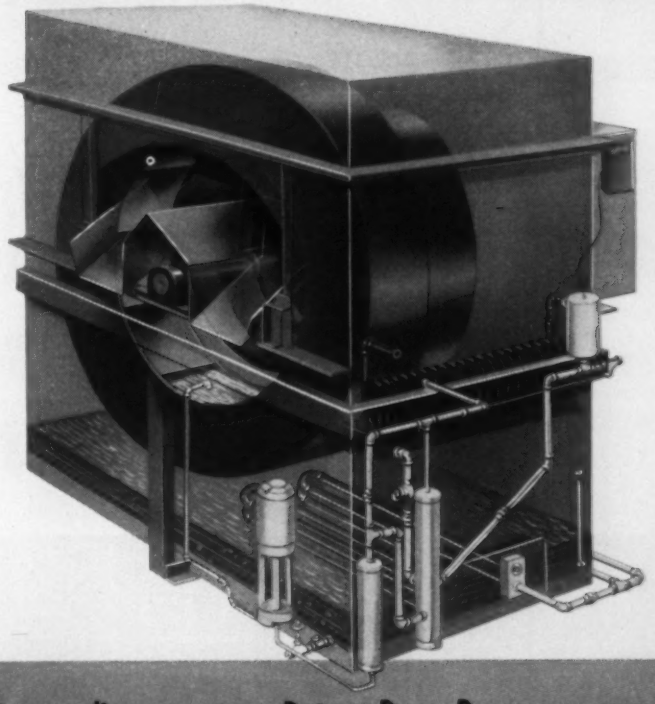
Oct. 16-18—

Computers in Control. Conference sponsored by Feedback Control Systems Committee of AIEE; Professional Group on Automatic Control of IRE; and Instrument and Regulator Department of ASME to be held Chalfonte-Haddon Hall, Atlantic City. Additional information may be obtained from AIEE headquarters, 33 W. 39th St., New York 18, N. Y.

Oct. 17-18—

National Conference on Industrial Hydraulics. Sponsored by Armour Research Foundation of

Revolutionary New Automated Degreaser by DETREX



Outstanding new type Rotary Drum Degreaser saves space, cuts costs, needs only small investment

Combining solvent degreasing with automated work handling, the new DETREX 1DD750 provides thorough cleaning of such products as nuts, bolts, fasteners, stampings and screw machine parts. In-process cleaning—cleaning before and after heat treatment—cleaning before plating, phosphatizing, bright dipping, etc. —final cleaning—all are handled with important savings in initial investment, operating costs and space requirements.

Steam heated and measuring only 6' 6" wide and 6' 0" high, and 4' 0" in direction of work flow, the 1DD750 handles five cubic feet per hour with a rated capacity of 2000 lbs. steel or brass per hour.

Only DETREX produces *both* equipment and chemicals to fill the widest range of metal cleaning and processing needs. DETREX can properly recommend, install and service the right combination of facilities for any cleaning application.

See Production Model of New DETREX 1DD750 in Operation at National Metal Exposition, International Amphitheatre, Chicago, November 4th through 8th, Booth No. 1316

DETREX CHEMICAL INDUSTRIES, INC.

BOX 501, DETROIT 32, MICHIGAN

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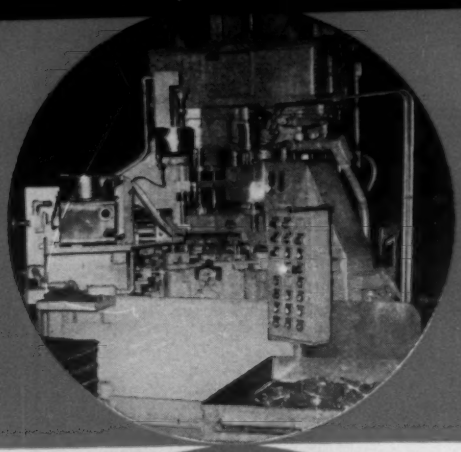

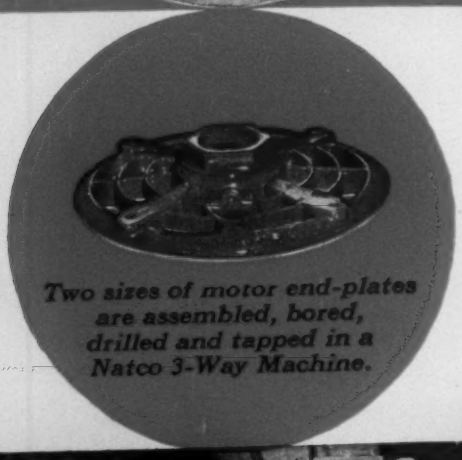

Two sizes of motor end-plates are assembled, bored, drilled and tapped in a Natco 3-Way Machine.

At Wagner Electric Corporation

One Natco

NATCO

Assembles, Bores, Drills and Taps... Reduces Labor Cost 70% On Small Motor End-Plates

This Natco combination assembly and multi-drilling machine presses a bearing sleeve into the end-plate, rough and finish bores the outside bearing-cap hole, drills an oiler hole at an angle, drills four (4) thru-bolt holes, and drills and taps two (2) 8x32 cover plate holes. *Production is 170 pieces per hour.*

This Natco accommodates two sizes of motor end-plates without changes in the basic rotary-table tooling. In addition to this important versatility the engineers at Wagner Electric point out these other advantages:

- *one operator* controls the assembly and machining from one station.
- *work scheduling* is simplified due to the short machine cycle.
- *in-process inventory* can be kept at a minimum because of high production rate.
- *floor space* is made available for other operations.

Natcos perform all kinds of drilling, boring, facing and tapping jobs in every conceivable combination and sequence.

Ask the Natco Field Engineer about the newly perfected tape control systems for Natco production tools.

National Automatic Tool Company, Inc.

Richmond, Indiana *Multi-spindle drilling, boring and tapping machines. Special machines for automatic production. Call Natco Offices in Chicago, Detroit, New York, Buffalo, Philadelphia, Cleveland, Los Angeles; distributors in other cities.*

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Illinois Institute of Technology. To be held Hotel Sherman, Chicago. Additional information may be obtained from Conference Secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

Oct. 24-26—

Computer Applications Symposium. Sponsored by Armour Research Foundation of Illinois Institute of Technology. To be held Hotel Sherman, Chicago. Additional information may be obtained from Conference Secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

Oct. 28-31—

Society of Industrial Packaging and Materials Handling Engineers. National Industrial Packaging and Handling Exposition of 1957 to be held Atlantic City. Additional information may be obtained from Hanson & Shea, Inc., Suite 759, One Gateway Center, Pittsburgh 22, Pa.

Nov. 4-6—

American Institute of Electrical Engineers. Machine Tool Conference to be held at Hotel Schroeder, Milwaukee, Wis. Additional information is available from E. F. Mekelburg, Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.

Nov. 4-8—

American Society for Metals. World Metallurgical Congress and National Metal Congress and Exposition to be held at International Amphitheatre, Chicago. Further information is available from American Society for Metals, 7301 Euclid Ave., Cleveland 4, O.

Nov. 4-8—

Institute on Electronics in Management. Program on Current Developments in Automatic Data Processing Systems to be held at Downtown Center of the American University in Washington, D. C. Additional information may be obtained from the American University, 1901 F St., N. W., Washington 6, D. C.

Nov. 7-8—

Third Electronic Business Systems Conference. To be held U. S. Grant Hotel, San Diego, Calif. Additional information may be obtained from Jac Wyman, Publicity Chairman, Third Electronic Business Systems Conference, P. O. Box 1448, San Diego 12, Calif.

Dec. 1-6—

American Society of Mechanical Engineers. Annual meeting to be held Hotels Statler, Sheraton and McAlpin, New York City. Additional information may be obtained from society headquarters, 29 West 39th St., New York 18, N. Y.

Dec. 2-6—

Twenty - sixth Exposition of Chemical Industries. To be held New York Coliseum. Additional information may be obtained from exposition manager, E. K. Stevens, 480 Lexington Ave., New York 17, N. Y.

Dec. 9-13—

Eastern Joint Computer Conference & Exhibit. Co-sponsored by IRE, AIEE and Association for Computing Machinery to be held Sheraton-Park Hotel, Washington, D. C. Additional information may be obtained from M. B. Catline, Council for Economic and Industry Research Inc., Arlington 2, Va.

Dec. 18-19—

Radio - Electronics - Television Manufacturers Association. Conference on maintainability of electronic equipment to be held University of Southern California, Los Angeles. Additional information may be obtained from association headquarters, 11 West 42nd St., New York 36, N. Y.

"According to the shop, about here the worktable was cut in half."

(Advertisement)

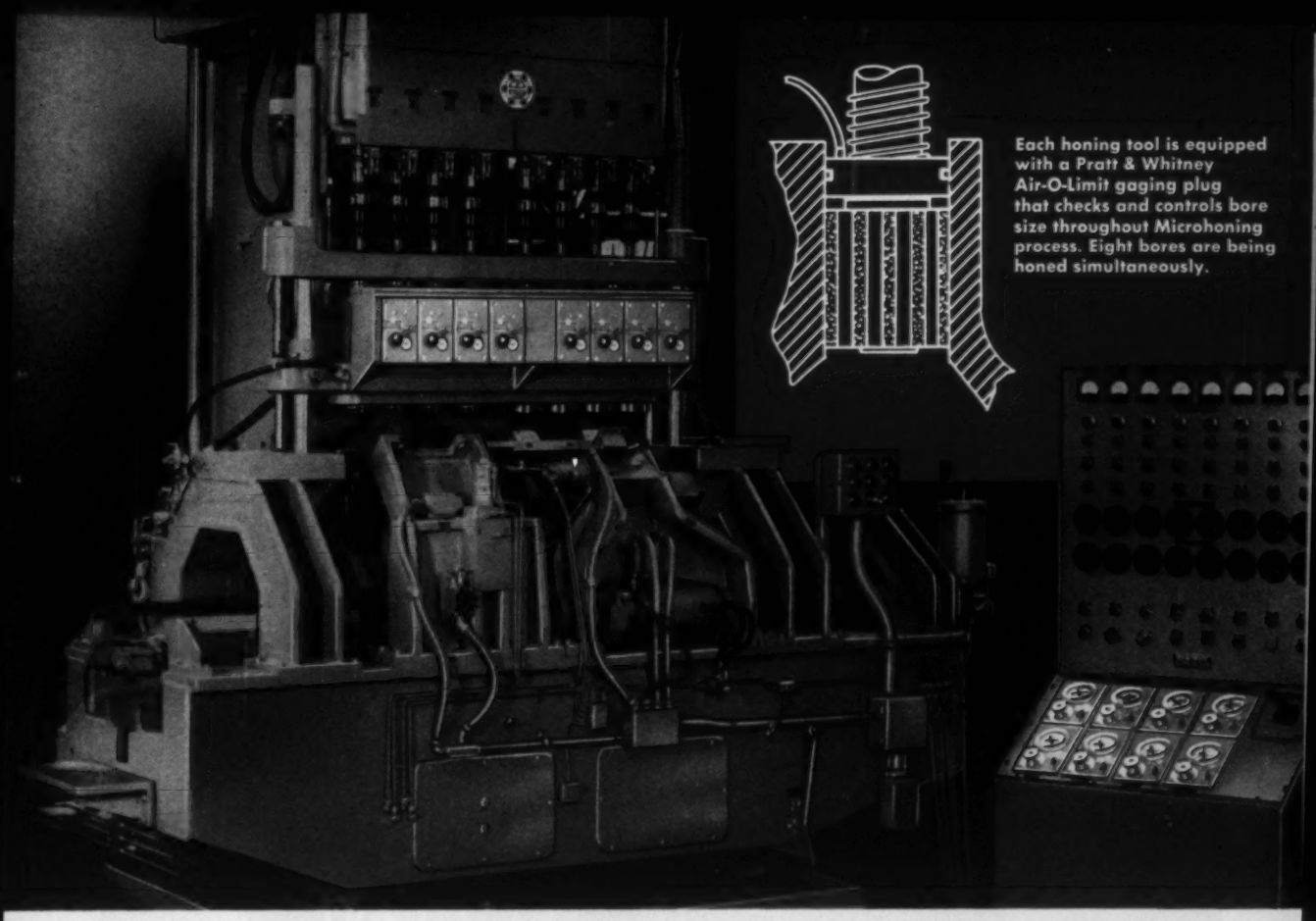
BUILD A GAGE INSTALLATION TO SUIT YOUR NEEDS . . .

with these packaged, on-the-shelf P&W Air-O-Limit Light Signal Units. Can be used to signal operator or to provide feed-back impulse for fully automatic process control.

BASIC 2-LIMIT UNIT . . . indicates high and low tolerances. Suitable for sorting and other "yes-or-no" control applications.

3-LIMIT UNIT . . . especially suited for grinding and similar operations. Indicates or automatically controls such conditions as: "Fast Feed," "Slow Feed," and "Spark-Out."

4-LIMIT UNIT . . . similar to 3-Limit Unit, but provides greater control scope. Indicates or controls such conditions as: "Approach High Limit," "High Limit," "Approach Low Limit" and "Low Limit."



Each honing tool is equipped with a Pratt & Whitney Air-O-Limit gaging plug that checks and controls bore size throughout Microhoning process. Eight bores are being honed simultaneously.

PHOTO COURTESY OF MICROMATIC HONE CORPORATION, DETROIT, MICH.

Make Your Investment in Precision Pay Off in PRODUCTION

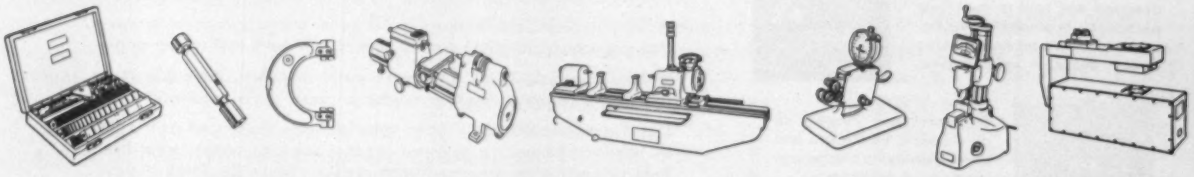
• • • • WITH PRATT & WHITNEY "PACKAGED" AUTOMATION GAGE UNITS

Applied to your precision production machines, "P&W Automation Gaging" will make it possible for you to increase production, reduce scrap losses and put to work more effectively the high precision built into your equipment. And in addition, the use of Pratt & Whitney standard, on-the-shelf Packaged Gage Units will provide an installation *custom-tailored* to your exact needs *WITHOUT* the expense and delays involved in engineering and constructing special controls.

In this example – a Micromatic Hydrohoner – automotive cylinder blocks are gaged *during* the Microhoning process. When final size is reached, the machine is automatically shut off and the Microhoning tools are retracted. A change to a different bore size can be made, without stopping the machine, by a simple adjustment on a calibrated gage control dial. Visual indication is given of the accuracy of the new adjustment. Cylinder blocks are produced at a rate of 120 per hour. Reject and scrap losses are virtually eliminated.

Make the most of *your* investment . . . make it a point to call in a P&W Field Engineer to analyze your production requirements and recommend the right P&W Automation Gaging installation to help you increase output, improve accuracy and reduce reject losses.

Pratt & Whitney Company, Incorporated,
35 Charter Oak Boulevard, West Hartford, Connecticut.



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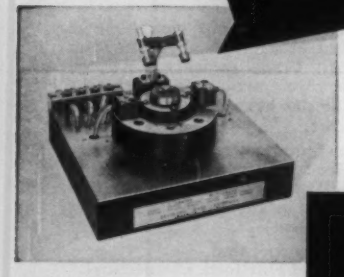
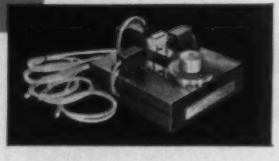


Special Air Gaging Fixtures designed and built to meet your particular application requirements. Complete engineering service available upon request.

Send part print showing all dimensions to be checked and tolerances required for prompt quotation and delivery.



To speed inspection of production parts, new Dearbornaire air gaging instruments are now offered in multiple column units designed to permit more accurate simultaneous checking of as many dimensions as may be required for a given part. What's more, each unit incorporates all of the advanced design features which have made Dearbornaire the most practical, most versatile column type instrument ever produced . . .

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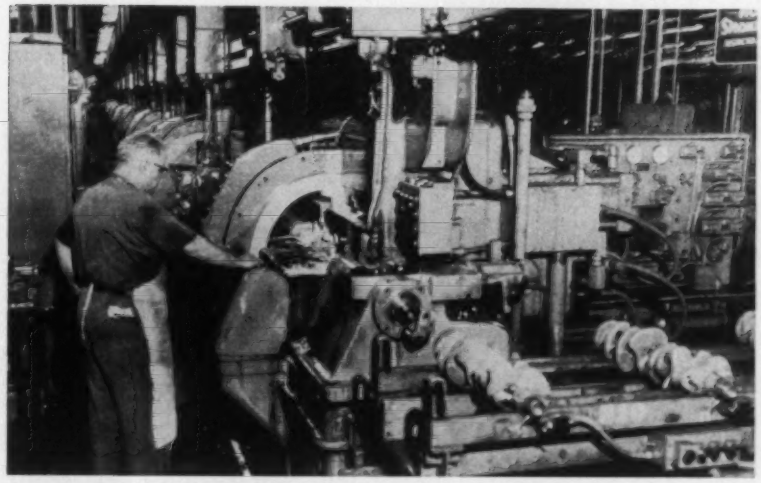
By JAMES C. KEEBLER
Managing Editor



Automated setup at Chrysler's Mound Road engine plant produces 1300 forged steel crankshafts per shift for Plymouth cars. This battery of automatic center drive lathes made by Wickes Machine Tool Division machines the main line bearing surfaces. Crankshafts are loaded and unloaded automatically. One operator tends three machines.

Crankshafts vs Turbine Shafts

DEVELOPMENTS of the jet age have suggested the advent of gas turbine driven autos and the dawn of a new era. Like automaters, gas turbine enthusiasts are sometimes looked upon as the pioneers of the twentieth century and sometimes considered to be infected with hot air.

Depending upon the point of view, followers of both of these endeavors may seem possessed with a full supply of both characteristics. The future will unveil interesting developments indeed when the automaters and the spinners of gas turbines get to working on the same projects in the shops of Detroit.

Just how soon the Hot Rod industry will be fully converted to the Hot Shaft or Hot Bucket business (your choice) is of course a matter of crystal ball work and few if any are the predictors who will assign a date to the end of the V-8. But there are those who see this eventuality as being as inevitable as was the passing of the straight line lazy eight—and not without reasoning to back up their reckoning.

Red Hot

Cartoonists once envisioned this auto to be without tail lights for it was hot enough to glow in the dark. However enough facts of automotive gas turbine developments have been revealed to supersede this design concept and indicate that much of the product development water is already over the dam.

A team of three GM experts reported to the SAE on "Aspects of the Automotive Gas Turbine for Military and Commercial Vehicles" (W. A. Turunen of the Gas Turbines Dept., General Motors Research Staff; R. Schilling of Research and Development, Chevrolet Engineering Center and E. L. Baugh of the Cleveland Ordnance Plant, Cadillac Motor Car Div.)

GM engineers have wheeled gas turbines in vehicles ranging from the light weight, high speed cars named Firebird I and Firebird II through the 45 passenger bus titled Turbocruiser to the heavy duty Chevrolet truck-tractor called Turbo-Titan.

One factor that was verified by all tests is that the turbine has more useable horsepower for the same installed horsepower. Put this together with the two clinchers: 1. Less space required per installed horsepower. 2. Less weight per horsepower. Conclusion: If its power you want, here's a good way to get it.

So the ground vehicle boys that need more power to pull freight over turnpikes and push dirt around off-the-road are in the same spot the fly boys were in when they needed more power and less nonpaying load. The solution of going to gas turbine engines appears indicated here too.

But developments in military aircraft have had a sense of urgency created by a guy named Joe. This urgency is backed by U. S. Treasury dollars and big gas turbines for big airplanes are highly developed.

Dr. Anselm Franz of Lycoming has previously told the SAE of their gas turbine developments for helicopters. He makes a point of design for low cost production. Engines in the lower power range, in contrast to large engines: 1. Are developed under different economic conditions. 2. Compete directly with reciprocating engines. 3. Do not have high military priority. 4. Can find a wide variety of applications and thus have development costs spread over a multiple number of potential marketplaces.

Though the cynics might suggest that the automakers already have their share of marketplaces sewed up, the Turunen-Schilling-Baugh paper supplies a list of advantages a mile long that indicate the customer would get a better deal if his next power plant were turbine driven.

GM now acknowledges that no additional engineering breakthroughs are required to put heavy turbine vehicles on the road,

but the cost of manufacturing remains unresolved because this type of engine has not yet been built in quantity using automotive production techniques.

Now we're back to the question of whether the chicken predates the egg or vice versa. Manufacturing methods are known that can make the required castings and stampings. Turbine wheels present fabrication problems.

Who is developing and marketing special automated production equipment for the fabrication of parts for small gas turbines?

Development costs for engines alone are high enough, not to consider development costs of manufacturing techniques. Small wonder the developers have prepared lists of requirements of power plants for military vehicles and are interesting the government in the tactical advantage of switching to turbines. Why not get your development money from them that's got it?

Modern Fable

The story is told of a staff group that was making a feasibility study for an automated line. The line would cost a potful of dough but the estimates looked like the proposed method would have an overall cost advantage over the present method. Then a sneaky division production engineer got wind of this and spent his whole budgeted methods improvement allowance on a simpler upgrading that put the present method back in the lead and cornballed the vast automation program.

Moral: The existing circumstance has a natural edge over a proposal fraught with unknowns so the innovators must have sharp minds and sharp pencils.

Would it be a good deal for the nation if the government did underwrite a development program for the fabrication of small gas turbine engines? One thing is certain: The manufacture of reciprocating engine parts is a highly developed technology and it is becoming more so all the time.

Crankout Shafts

Take the crankshaft as a case in point. The crank is the symbolic essence of the reciprocating engine. Some cast them, others forge them, but everybody machines the main bearing surfaces and the crankpin bearing surfaces and has already spent a pot and a half full of dough on machines to do this.

Handling devices pick these heavy workpieces up from the conveyors, load them into the machines where they are positioned and clamped. Automatic cycles perform the machining or grinding operation (as the case may be) and unclamp the piece so the unloading device can move it to the take-away conveyor.

So it is with round one, but the machine development bout has moved past that point and is now well into round two. Existing automation ideas are being revised to reduce handling time, equipment costs, floor space and machining time, such that overall manufacturing costs can be reduced.

Norton's No. 2 crankpin grinding setup improves upon the first design, and features a double hook arrangement on the transfer carrier that unloads and loads the grinders. With this design the unground shaft is held above the chucks while the unloading takes place. Loading follows immediately without waiting for the carrier to traverse to another position. All traversing action of the carrier takes place during the grinding cycle and therefore doesn't add to the machining cycle.

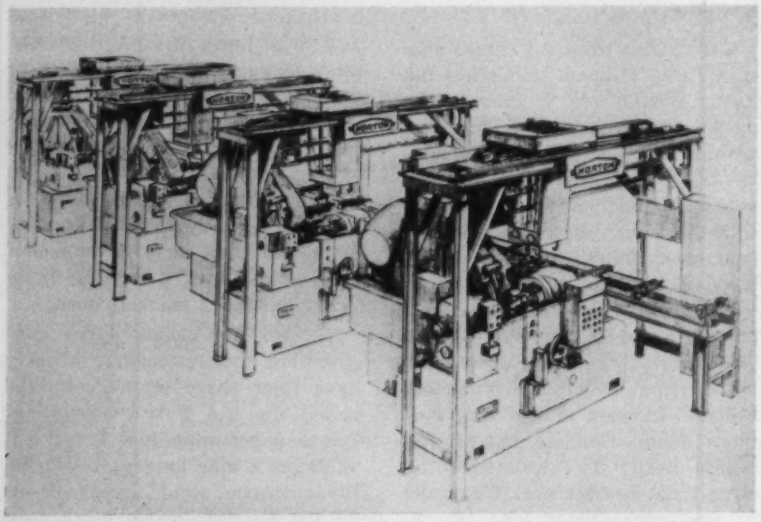
New workholder design eliminates the separate function of locating the crankshaft in the correct angular position. Shaft is placed in proper angular location when it is deposited in the chuck.

Crankpin grinding operations are not alone in being developed past the first steps into automation. Wickes Machine Tool Div. reveals that it has developed and will soon unveil a new arrangement for machining crankpins prior to grinding. Here again the emphasis is on an overall machine development to do the job better at less cost than was previously the practice.

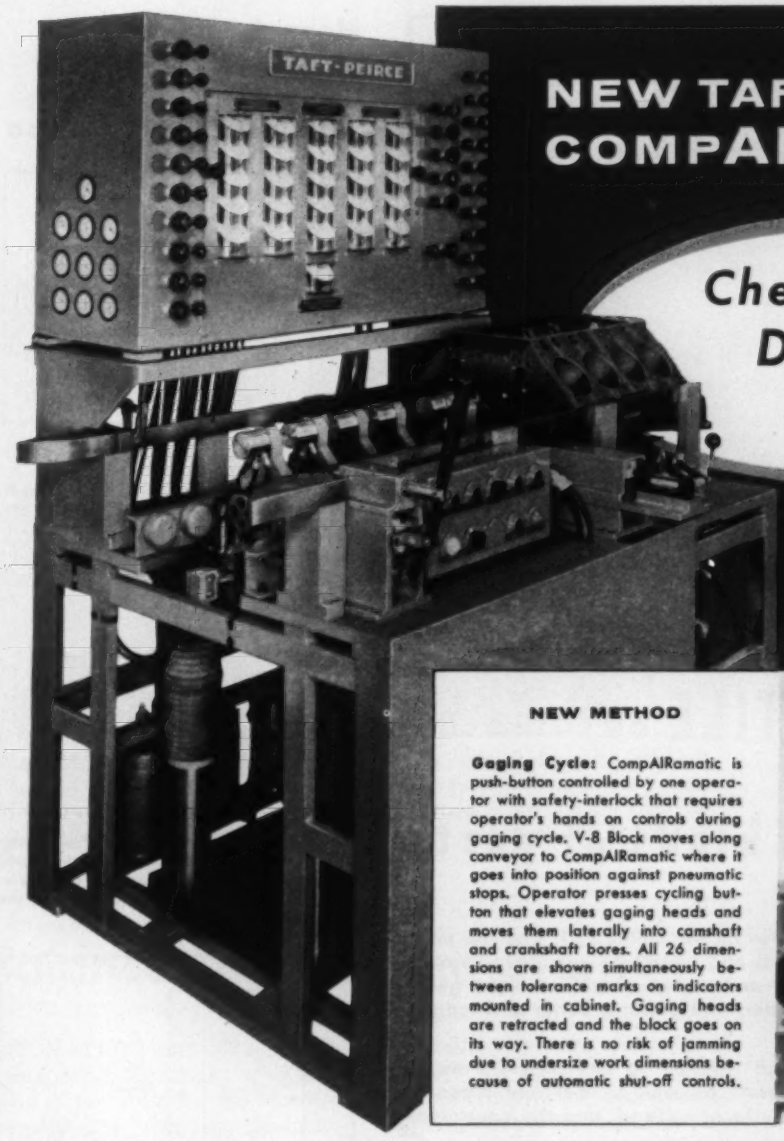
New Bout

You might look at a gas turbine shaft that has no crankpins and say that it is simpler to make than a crankshaft. On the other hand if you've taken the pain out of making crankshafts you might hesitate before starting again at round one with a new manufacturing development program.

Most likely with automotive gas turbines as with automation it will be evolution—not revolution—that will characterize the changeover. The automotive gas turbine is at the beginning of its development cycle and the developments will be interesting to follow.



Sketch of automated line developed by Norton to grind crankpin bearing surfaces of crankshafts. Called the No. 2 Unitized Transfer Type Automatic Crankpin Grinding Machine, this equipment is composed of four separate grinders. Each unit grinds a single pin and functions independently of the other units. Handling equipment loads, positions and unloads workpieces and transfers them between grinders.



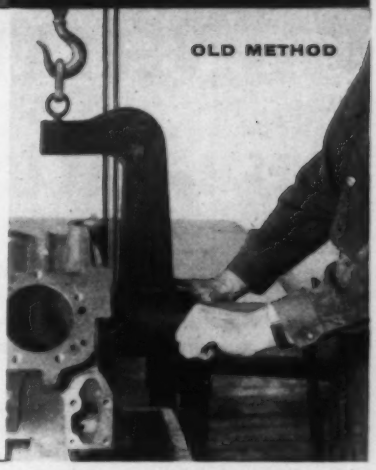
NEW TAFT-PEIRCE COMPAIRAMATIC

Checks 26 Dimensions at once!

Air Gaging and workhandling combined for Push-Button Gaging Crankshaft and Camshaft Bores, and Presence of Oil Holes in V-8 Engine Blocks.

NEW METHOD

Gaging Cycle: CompAIRamatic is push-button controlled by one operator with safety-interlock that requires operator's hands on controls during gaging cycle. V-8 Block moves along conveyor to CompAIRamatic where it goes into position against pneumatic stops. Operator presses cycling button that elevates gaging heads and moves them laterally into camshaft and crankshaft bores. All 26 dimensions are shown simultaneously between tolerance marks on indicators mounted in cabinet. Gaging heads are retracted and the block goes on its way. There is no risk of jamming due to undersize work dimensions because of automatic shut-off controls.



OLD METHOD

Here is a semi-automatic air gaging unit that replaces multi-step, time consuming quality control with a single, low-cost operation.

Problem: Long, counterbalanced air plug gage on hoist had to be centered and inserted through camshaft bores by the operator. Another air plug gage was required for crankshaft bores, while another gaging method was used for checking presence of oil holes. Although gaging was accurate, the operation was inefficient and tiring for the operator.

Solution: Taft-Peirce developed this 26-dial CompAIRamatic that simultaneously indicates: 1. 5 cam bore diameters in two planes within .0015" total tolerance. 2. 5 crank bore diameters in two planes within .002" total tolerance. 3. Cam counterbore within .0005" total tolerance. 4. Presence of oil hole reservoir in 5 cam bores (using patented Taft-Peirce Comp-Utair Air Gaging Circuit).

Bring new cost savings to your quality control. Let Taft-Peirce help you engineer new air gaging concepts into your production line — from single dial units to multi-dial air-electric units for fully-automatic operations. Contact your nearest Taft-Peirce representative or write Taft-Peirce Manufacturing Company, Woonsocket, R. I.

Free Booklet "6 Special Ways to Air Gage For Lower Costs, Higher Production" shows typical T-P CompAIRamatic installations. Write for your copy.

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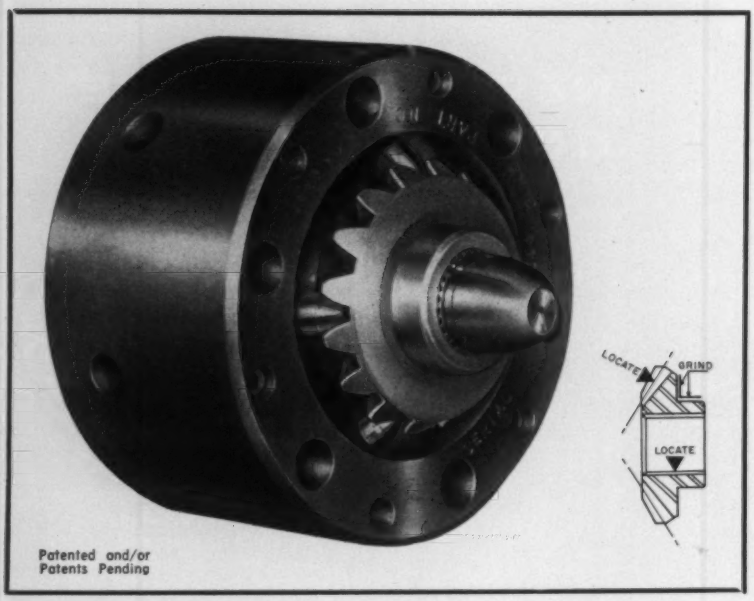

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Here it handles a bevel gear. Locates by the spline I. D. and the pitch line of the bevel teeth while the hub and gear face are ground simultaneously. This insures concentricity and uniform backlash—and gears which will assemble easier and faster, and perform better and longer.

This basic chuck, with slight design changes to suit different work-conditions, will handle non-gear parts as well as different types of gears. The locating and clamping surfaces utilized, and the operations to be performed, can vary freely.

Developed especially for automated machines, it combines rapid, automatic operation with rugged construction to assure uninterrupted high production. Small in diameter, and light in weight, "flywheeling" is no problem—non-productive machine time is reduced to a minimum and braking problems are eliminated. A built-in synchronizer permits loading and ejecting work without stopping the workspindle if that is desirable. Compact and completely self-contained, this chuck mounts easily and quickly as a unit. Thru one connection to the draw bar, or power source, all automatic loading, clamping, and unloading features are controlled—and the unit is easily safetied and interlocked with machine components and gaging equipment. Extremely short overhang puts the workpiece back close to the workspindle bearing—assuring the ultimate in finish and roundness, and longer bearing life.

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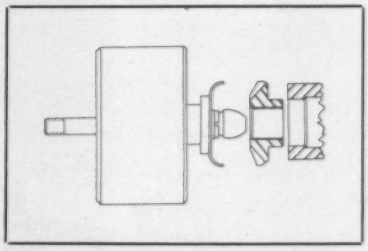
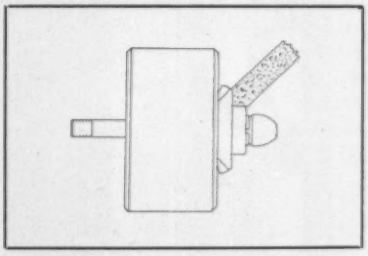
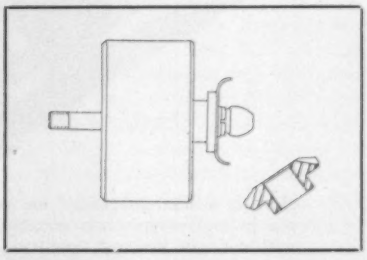
Here is HOW it handles gears, and other parts, too



The synchronizing "hand" automatically moves forward from the chuck proper, receives the workpiece from the automatic loader, moves backward and chucks the workpiece *accurately* and *securely*.



The synchronizing "hand", after completing the chucking, automatically starts the actual grinding or machining operations which continue until stopped by a signal from the gaging system.



When the workpiece has been finished to size, the synchronizing "hand" automatically ejects the finished part—receives a new part from the automatic loader and starts the machine cycle again, automatically.

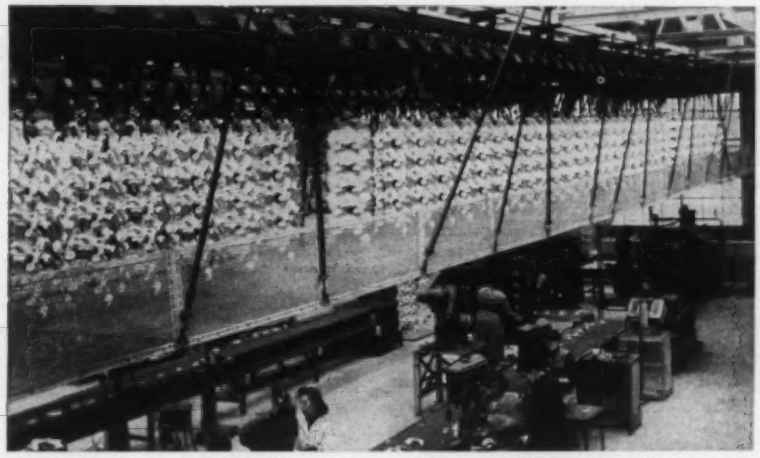
•

For those occasional jobs which verge on being impossible-to-chuck, we have other new types of chucks developed especially for automated installations. One is sure to be perfectly-suited to your requirements. If not, we will start from scratch and produce an outstanding chuck for your special use and purpose. What's your problem?

GARRISON MACHINE WORKS, INC. DAYTON 4, OHIO, U.S.A.

notes from britain

By FRANK G. WOOLLARD
British Correspondent



General view of beginning of diecasting line. In this view at commencement of morning shift, overhead storage conveyors contain products from previous night's casting operation. Use of extensive storage conveyor for each diecasting machine permits flexibility in timing of sequential production operations.

Balance, Timing and Storage

AUTOMATION principles solved a very difficult problem, or rather series of problems, for the Wolverhampton Die Casting Company Ltd., makers of diecastings of all kinds, but more especially for the automobile industry. These particular problems were in connection with door furniture and similar fittings. It was a matter of balance, of timing and storage.

The Schultz diecasting machines are operated by men and worked continuously for a week at a time: sometimes on the 3-shift system, sometimes on two long shifts. The trimming of the castings is performed by female labour working a daylight shift only. The situation was made much more difficult since there are many different types of castings necessitating fairly frequent die changes. Palletised storage was no answer because of the large area required and because of the difficulty of storing the boxes in get-at-able sequence. Moreover, box storage was responsible for much surface damage to the parts which had eventually to be plated. It was evident that storage was the key to the problem, but storage so arranged that (1) it would be large enough to accommodate castings of different sizes and complexity, (2) a change of dies could be met by a change of trimming tools, (3) the parts could be fed in a predetermined sequence to the trimmers and (4) surface damage and breakages could be reduced to the absolute minimum.

Storage Conveyor Needed

In the interest of conserving floor area for maximum production it was decided to accommodate the storage in the roof of the single storey shop. Other problems were obvious in respect of feeding molten metal to the casting machines, getting at the machines to change dies and handling the surplus metal arising from the casting operation.

The greatest problem was that of a choice of the main conveyor which had to be of an automatic storage type, which had to drop abruptly to ground level to receive the castings from the machine, rise to the storage area and deliver at ground level for the trimming line: the space for the rise and fall was strictly limited. The conveyor chosen was the "Flowmaster" built by Fisher & Ludlow Ltd., which had all the essential features and which (being built up entirely of pressed parts) would be very light on the roof principals.

The Flowmaster conveyor consists of two superimposed tracks held together by straddle plates. The top track carries the operating chain which is made up of flat plates coupled by cruciform units, the arms of which carry ball bearings. The bearings in the horizontal plane carry the weight of the chain, those in the vertical plane act as guides for cornering. The chain is fitted with a series of pawl mechanisms for moving the load trolleys.

The lower track carries the load trolleys which also run on frictionless bearings. These load trolleys can be fitted with any type of work carrier. On the top of the load trolley there is a projection or dog with which the pawl mechanism can engage.

There are two pawls, one for driving and the other to hold the load on a downward slope. The pawls can be controlled by means of flap plates which can engage and lift the pawl clear of the dogs, or it can permit the pawl to engage a dog. In the first place the carrier stands still, in the second it

moves forward until it is disengaged by a later flap mechanism. By these means the work pieces can be passed into storage to await the call of the trimming benches.

Integrated Into the System

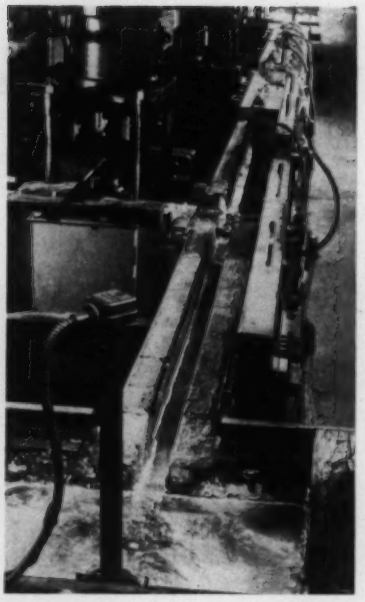
Each of the diecasting machines has its own conveyor to supply the appropriate trimming line — the conveyor, nearly 400 feet in length, is accommodated in several loops above the trimming line. The fact that this type of conveyor only needs bends of small radius is very helpful in packing the storage into a relatively small space. The carriers are made in the form of trees and the sprays of die castings are hung on the branches at such spacings that they cannot touch each other. When the die caster has filled a tree there are two alternatives: (1) the conveyor can proceed immediately to the storage area whence it is released as required or (2) it can be delivered direct to the trimmers. At night the trees are delivered direct to the storage area from which they are called by the trimmers, by press button operation, the following morning.

When sprays of castings are taken from the trees they pass through a press operation to remove the sprues and runners and flash, after which the individual castings proceed on a belt conveyor, flanking which are operators with the necessary presses, drills, broaches and other tools for machining the piece parts.

Inspection takes place at the end of the trimming lines and then the parts are ploughed off onto the packing conveyor and loaded into palletised boxes for transportation to the customers' works where they are chromium plated and assembled.

The surplus metal drops onto a belt conveyor which takes it to a remelting plant where the metal is reingotted and analyzed to ensure that it is consistent with the standard composition laid down by the British Standards Institution.

The diecasting machines are controlled by electronic devices which give complete control of the operation cycle. The holding pots for the plunger type machines are connected with two 60 kw melting furnaces by means of resistance heated launder troughs so that delays in filling from runway-carried crucibles is entirely eliminated.



Two melting furnaces are connected by a heated trough from which diecasting machines are served. Setup eliminates possibility of delays in diecasting operations.

The advantages in this automatically controlled plant are many:

1. The whole of the operations are under managerial control from start to finish.
2. There are no floor stocks to encumber the work area.
3. There is little or no damage to finished parts.
4. The inventory is reduced to a minimum.
5. The work pieces come to the trimming lines in the same order as made, although interim changes of dies can be accommodated.
6. The storage provides a buffer stock from the die changing operation, i.e. the trimmers can continue with their work while the dies are being changed.
7. The diecasting can proceed while the trimming tools are being changed.
8. There is virtually no labour cost for transport since this is all done by conveyors.
9. The amount of work handled per square foot of floor space is greatly increased.

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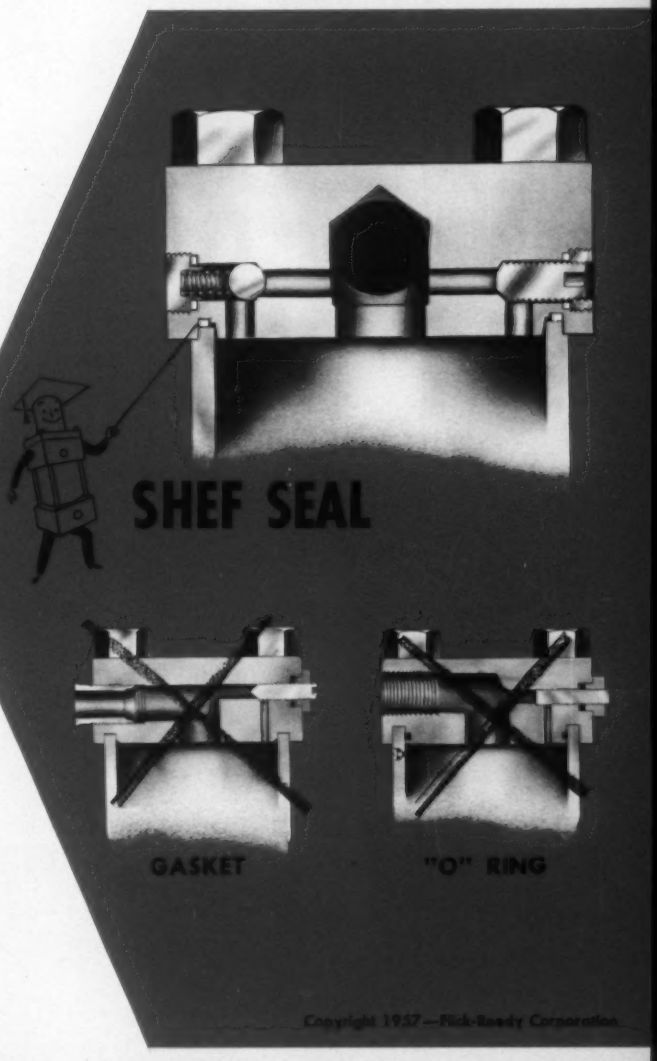
5. Head and Cap Axial Movement Does Not Destroy Sealing.
6. Allows Air Bleed In Head and Cap for Remote or Automatic Bleeding.
7. One Sealing Ring Cross Section Dimension For All Cylinder Sizes—Supplied On Convenient Spools.
8. Zero Metal Backup Clearance Eliminates Dangerous Leaks and Spurts of Fluid Due To Seal Failure.



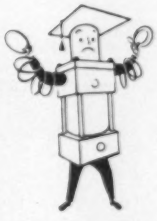
NONE OF THESE DISADVANTAGES

GASKET CONSTRUCTION

1. Unpredictable Results—Leaks and Blows Even at Low Pressures.
2. Outlawed by J.I.C. Eight Years Ago.
3. Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.

"O" RING CONSTRUCTION

1. High Pressures and Shock Loads Expand Tubing—Increase Clearance and Cause Extrusion.
2. Blind Assembly Can Shear Sealing Ring—Difficult Servicing.
3. Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.
4. Requires Large Inventory of "O" Rings
   —For Servicing Variety of Cylinder Bores.
   —For Special Synthetic Rubber Compounds To Meet Ever Changing Fluid and Temperature Needs.



*du Pont trademark for its tetrafluoroethylene resin.

SHEF SEAL—*Another Miller "First"*

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H HEAT PROOF
E EXTRUSION PROOF
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SEAL
Teflon Pressure Energized
Hydraulic Cylinder Tubing End Seal
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- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
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- Teflon Oil and Dirt Wipers

Miller FLUID POWER DIVISION
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1. Impervious to Every Hydraulic Fluid Including Fire-Resistant Types.
2. Seals Perfectly in Cylinders at Temperatures from —100° F. to 500° F.
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4. With Proper Design of External Seal Cavities, Teflon Can Be Included *Without* Increasing Prices. Miller Provides Teflon for all External Seals at Prices Competitive with Ordinary Cylinders. Leather Internal Piston Cups are Standard (Teflon Cups Extra).

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You buy extra years
of worry-free
Cylinder performance
...at competitive prices

NONE OF THESE DISADVANTAGES

Synthetic Rubber— As Static and Dynamic Seals

1. Unsatisfactory Except When Used With A Limited Range of Hydraulic Fluids.
2. Even Uncontrollable Changes in Fluid Additives Often Destroy Seal.
3. Specific Compounds Needed for Compatibility with Specific Fluids Normally Used Today.
4. Normal Temperature Range Limited to 0° F. to 130° F. Slightly Reduced Life When Operated at 130° F. to 150° F. Greatly Reduced Life at 150° F. to 250° F.
5. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.
6. "U" Type Seals Without Mechanical Retainer at Mid-Section Frequently "Roll" and Lose All Sealing Ability.

Resin Impregnated Leather— As Dynamic Seals Only

1. Is Compatible with Many—But Not All—Hydraulic Fluids and Additives Including a few Fire-Resistant Types.
2. Normal Temperature Range Limited to —60° F. to 130° F. Slightly Reduced Life When Operated at 130° F. to 150° F. Substantially Reduced Life at 150° F. to 250° F.
3. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.

   Miller Uses Leather Piston Cup Seals for Internal Sealing... Standard Price (Teflon Cups Extra).

Piston Rings— As Dynamic Internal Seals

1. Most Piston Rings Allow Some Leakage.
2. Allow "Slip" or "Drift" of Piston Due To Leakage—Unsatisfactory for Many Applications.
3. Allow Varying Feed Rates Due To Leakage Because Of Viscosity Change During Startup—Unsatisfactory for Most Multiple and Automated Operations.
4. Allow Some Pressure Loss.
5. Chips and Dirt Enter Space Between Piston and Tube Causing Scoring —Especially During Startup.

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Bugs?

For many years the majority of industrial firms have been users of standard types of production equipment. Few buyers of machinery have had to contend with costs of developing and perfecting such equipment. The costs of proving out new production machines have been absorbed by the builder over years of model production; sometimes in hopes of years of model production.

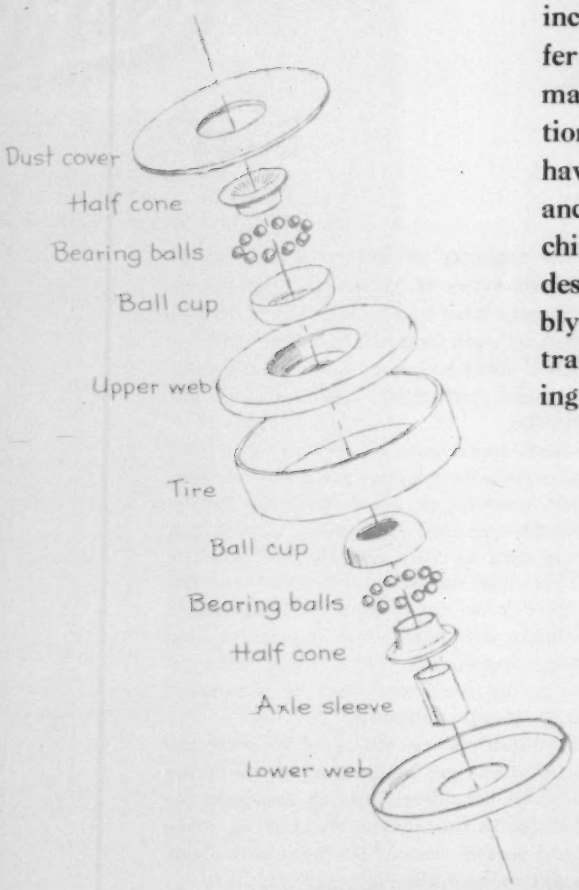
Special equipment—the largest category where automated production equipment is concerned—poses a new problem. Who absorbs these costs? Each machine or line is new and for the most part unique. Although standard engineering approaches, devices and techniques are used to the greatest extent possible, the finished equipment is still basically different in many aspects. For the user there is no easy answer to the nagging question of how to eliminate debugging—the tedious proving out of the automatic line in production. You can't. But experience and know-how in the particular field of automated operations can reduce it to a bare minimum.

There are always the questions concerning engineering and debugging costs where quotations are being studied. Whether such costs are shown or even considered in cost analyses, the unknown and unsuspected quirks that invariably show up when equipment is first put into service cannot be bargained away. The perfect machine is yet to be built.

Automation cost evaluations should always allow for debugging. It is accepted practice among long-time users of special automatic equipment. Depending on experience and complexity of the equipment, this allowance may run from 20 per cent to as much as 100 per cent of the line cost. Time is involved and debugging under production conditions is most difficult to accomplish.

Although in-plant debugging costs are seldom recorded, it is sheer folly to assume there are none. The facts are in the record. It is time production managers and manufacturing engineers face them squarely and recognize the "bugs" as one of the inherent costs of automation. To assist in this regard a significant portion of the "Second Conference on Manufacturing Automation" is focused squarely on this and other phases of the equipment cost and payoff problem. Again cosponsored by AUTOMATION and Purdue University, the program will bring to light fundamental and authoritative facts on this important area in automation planning.

EDITOR



Appearance on the industrial scene of an increasing variety of standardized transfer bases and accessory tooling is enabling many manufacturers to automate production operations which heretofore would not have been considered because of the time and cost required to develop special machinery from the ground up. This article describes an automatic skate wheel assembly machine which is built on a standard transfer unit and includes basic parts feeding and tooling units.

By E. GORDON READER
Vice President & General Manager
Ferguson Machine Corp.
St. Louis, Mo.

TOOLING FOR

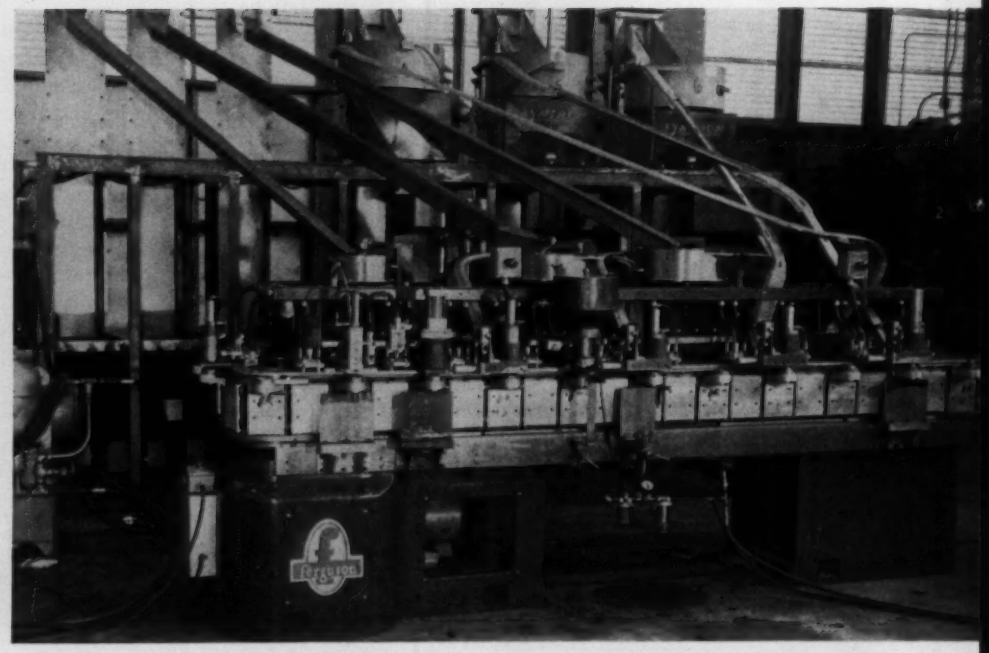


Fig. 1—In-line transfer machine automatically assembles roller skate wheels consisting of 20 bearing balls and 9 other parts. Rack in background contains bulk parts bins and supports six magnetic elevator-conveyors and three large vibratory parts feeders.

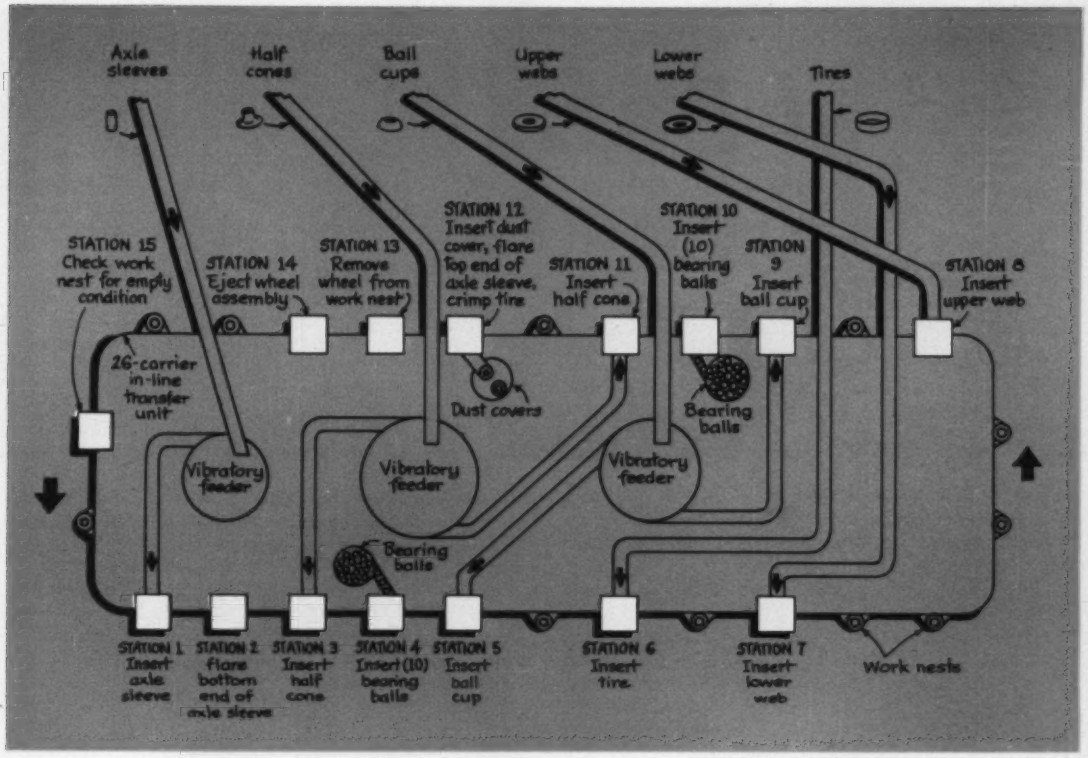

Axle sleeves
Half cones
Ball cups
Upper webs
Lower webs
Tires
STATION 15 Check work nest for empty condition
STATION 14 Eject wheel assembly
STATION 13 Remove wheel from work nest
STATION 12 Insert dust cover, flare top end of axle sleeve, crimp tire
STATION 11 Insert half cone
STATION 10 Insert (10) bearing balls
STATION 9 Insert ball cup
STATION 8 Insert upper web
26-carrier in-line transfer unit
Dust covers
Bearing balls
Vibratory feeder
Vibratory feeder
Vibratory feeder
Bearing balls
STATION 1 Insert axle sleeve
STATION 2 Flare bottom end of axle sleeve
STATION 3 Insert half cone
STATION 4 Insert (10) bearing balls
STATION 5 Insert ball cup
STATION 6 Insert tire
STATION 7 Insert lower web
Work nests

Fig. 2—Schematic diagram illustrates general layout and direction of flow of parts for automatic wheel assembly machine.

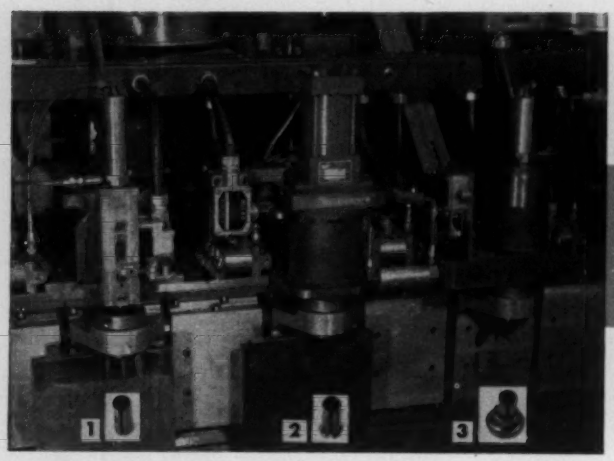
AUTOMATIC ASSEMBLY

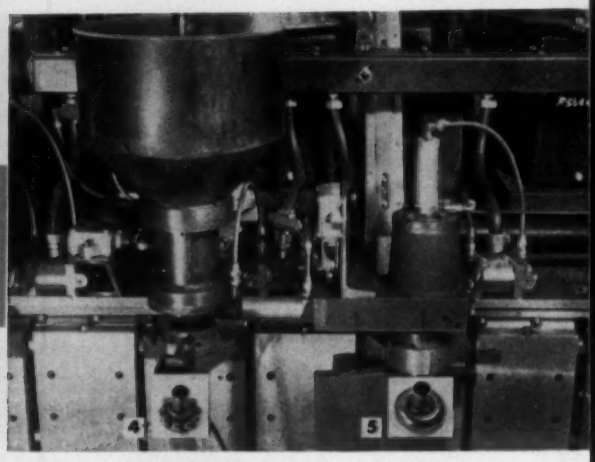
IN SKATE WHEEL PRODUCTION

FEASIBILITY of automating assembly operations is usually more probable when large quantities of parts are involved and when design is such as to facilitate automatic handling. While final product quantities are most often determined by a combination of factors—market demand, effectiveness of advertising, replacement rates, etc.—which may not be subject to ready manipulation, a critical re-examination of the product line sometimes can reveal unsuspected additive effects on subassembly requirements which qualify these components for consideration. For example, when several models in a line use the same or basically a similar subassembly, or when one model employs in its construction several identical assembled components, there exists for these parts an "amplification factor" which frequently can pass an otherwise unlikely candidate into the realm of feasibility.

This is not to imply that automatic assembling facilities are never justifiable for products or components which are manufactured in low volumes. But in either case it is important to ferret out at the beginning every part which might be run on the machine contemplated. With this knowledge a more accurate estimate can be made of the gains which might be realized through application of the techniques of automation.

After requirements have been set and a favorable potential has been established, the product or subassembly under consideration should be examined for its amenability to automatic handling. This is an area which requires the most detailed scrutiny, and the faculty of visualizing the flow of parts and all the forces which will act on them is of inestimable value in this phase. Often, the design changes which are found to be desirable from a handling standpoint may so simplify the part as to produce additional manufacturing savings. On the other hand, changes which would require retooling or extensive modifications to existing piece part tooling might result in a loss.





Station 1—Axle sleeve is fed from hopper and positioned by ram onto a pin in the work nest.
Station 2—Bottom of axle sleeve is flared by air-actuated ram.
Station 3—Half cone is hopper fed and placed over axle sleeve.

Station 4—Ten bearing balls are fed into nest and positioned around half cone by action of small vibrating device.

Station 5—Ball cup is hopper fed, pushed into the nest and placed over the bearing balls.

Fig. 3—Steps in buildup of skate wheels on in-line transfer machine are illustrated by closeups of work stations and insets showing stages of fabrication.

In either case, the effect of such changes may have a strong influence on the outcome of the feasibility study, and should be accounted for at the outset.

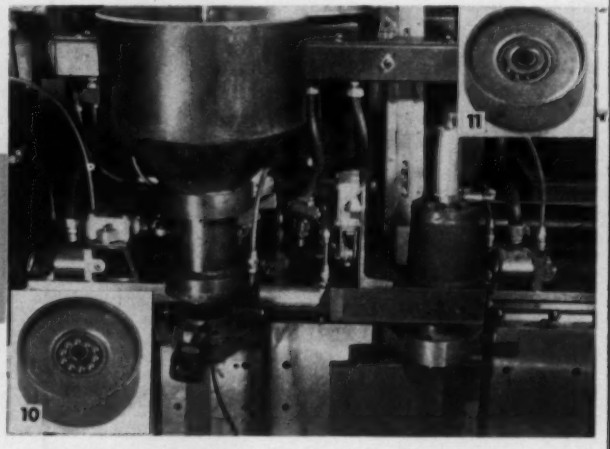
A Case in Point

Experience of one manufacturer of a line of roller skates exemplifies the application of these principles in judging the feasibility of automatic assembly equipment for one of their components. Realizing that the maintenance of a favorable marketing position in the field would require constant vigilance and progress in reducing manufacturing costs, the management of this company decided to review all of their production operations. Specifically, their efforts were directed toward greater application of the techniques of automation.

With four wheels to each skate, and several skate models using the same or a nearly identical type of wheel, they had no difficulty in determining an area in which substantial savings might be realized. It was decided to check the feasibility of assembling the wheels automatically. As should be the case, first thought was given to the product itself, and some design changes were made to make the wheel more conducive to automatic assembly. Next, several tooling design and building groups were called in.

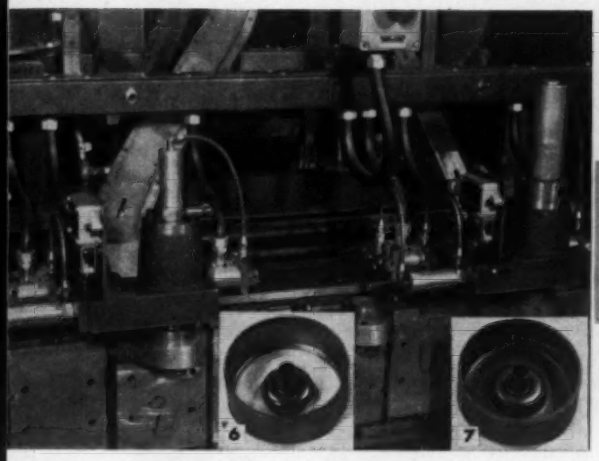
A proposal submitted by Ferguson Machine Corp. to design and build an automatic assembly machine which would produce 30 ball-bearing skate wheels a minute, and which would require the attention of only one observer-operator, was accepted.

The resulting in-line transfer machine, *Fig.* 1, assembles wheels consisting of 20 bearing balls and 9 other parts. By making a minor change to one station and shutting down two other stations, the machine will assemble a similar but more simply constructed skate wheel. In addition to automatic feeding and placement of parts, the machine per-



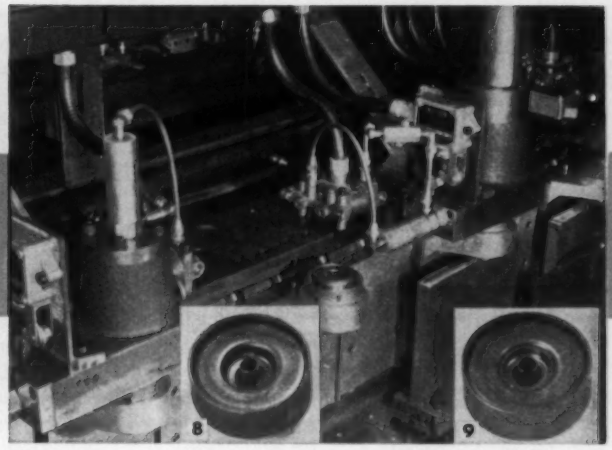
Station 10—Ten bearing balls are fed into the nest as in Station 4.

Station 11—Second half cone is positioned in the assembly.



Station 6—Tire is fed from hopper on rack and pushed into nest by ram.

Station 7—Lower web is forced into nest, firmly seating ball cup around balls and axle sleeve.



Station 8—Upper web is fed from hopper and pushed into nest by air-actuated ram.

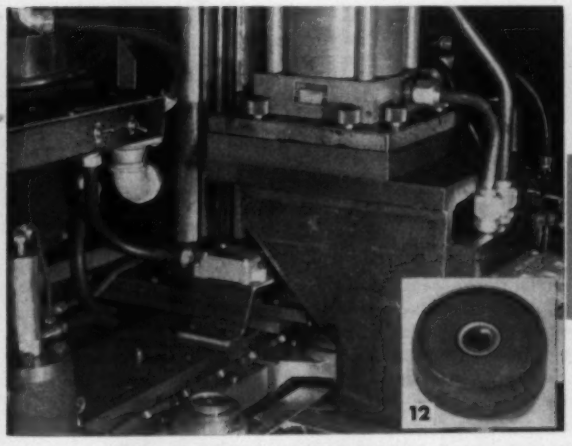
Station 9—Another ball cup is added to the assembly.

forms the operations of flaring both ends of the axle sleeve and crimping the tire. The mechanisms for removing the completed assembly from the work nest, ejecting the wheel from the machine, and inspecting the work nest for an empty condition occupy three additional transfer positions. In *Fig.* 2 is shown the general layout of the machine.

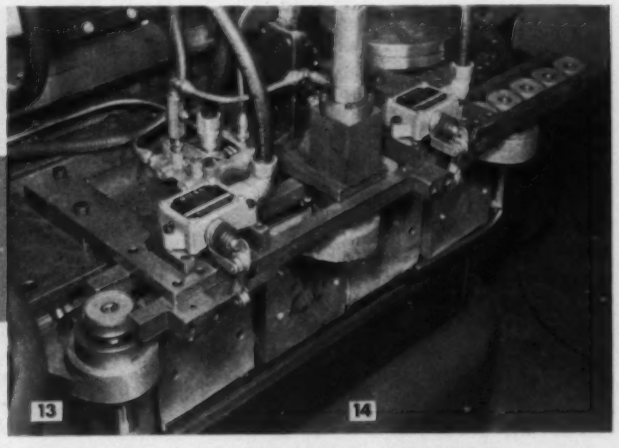
Design and Operation

A standard 26-carrier Trans-O-Mator in-line transfer base, 11-feet long, which has a 1-foot spacing between carriers and 1-foot carrier movement between dwells, was chosen as the basic unit for the skate wheel assembly machine. Indexed by a roller-gear drive, this unit features low maintenance and smooth indexing. The latter is a characteristic of some importance in this application, as will be shown.

To the carriers were added 26 work nests, and the base was fitted with the parts feeding, forming, testing and ejecting mechanisms required at the various stations. Some of these mechanisms are detailed in *Figs.* 5 through 9. Also mounted on the base are the three smallest vibratory feeders which deliver properly oriented axle sleeves, half cones, and ball cups. Since half cones are in-



Station 12—Dust shield is magazine fed and located in place by magnet. Ram inserts dust cover, flares upper end of axle sleeve and crimps the tire.



Station 13—Cam raises portion of work holding nest so that wheel assembly enters between parallel guides.

Station 14—Nest section is rammed back into fixture, freeing the wheel assembly. Completed wheel is picked off at end of guides.

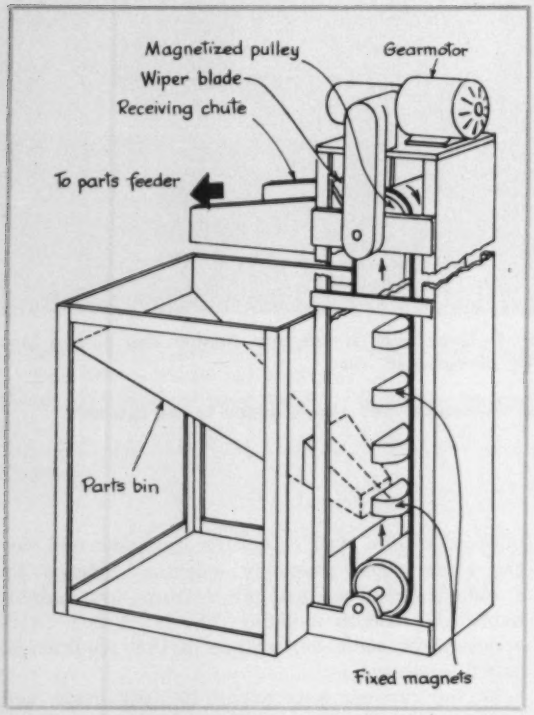


Fig. 4—Attractive force of spaced magnets acting through the belt, combined with upward motion of the belt, lifts steel parts from the bulk parts bin to receiving chute above. Elevator-conveyors are automatically started and stopped through action of level switches on vibratory feeder bowls.

serted at Stations 3 and 11, and ball cups are used at Stations 5 and 9, the feeder bowls for these parts each have two outlet tracks. One track leading from each of these feeder bowls is twisted 180 degrees because of the inverted position in which one half of the parts are assembled. Details of the principal steps in assembling the wheels are shown in *Fig.* 3.

One of the most difficult operations required of the automatic wheel assembly machine proved to be the placing of exactly ten ¼-inch diameter bearing balls in a circle having a pitch diameter of ⅝-inch, as at Stations 4 and 10. Conventional types of ball escapement mechanisms were not suitable because of the large number of balls to be handled at one time and because of the restricted space available. A special ball-feeding and placing mechanism was developed, *Fig.* 6, in which ten separate tubes leading from a common reservoir release bearing balls to the work nests. Upon a signal, these feeding assemblies lower into the nests at Stations 4 and 10, deposit the bearing balls in a circle and retract before the next index. Even though the drop distance for the balls is very slight, there was a tendency for the balls to overlap or stack, causing a possible malfunction at the next stations. A small vibrating device, which imparts its vibration to the work nests at each ball-feeding station and shakes the balls into position, provides an effective remedy.

It is during the travel of the work nests between Stations 4 and 10 and their succeeding stations that the smooth indexing characteristic of the roller-gear drive proves vital. Bearing balls are virtually free in the nests at this time, and any excessive jarring in this condition would tend to disarrange them. The roller-gear indexing mechanism, by virtue of the modified trapezoidal acceleration and deceleration it imparts to the carriers, effects a smooth transition without disturbing the circular pattern of the bearing balls. It should be pointed out also that the indexing precision of the roller gear mechanism is such that no auxiliary locating means are required, nor is it necessary that any of the stations be floated.

With two exceptions, bearing balls and dust covers, parts to be assembled are fed from vibratory

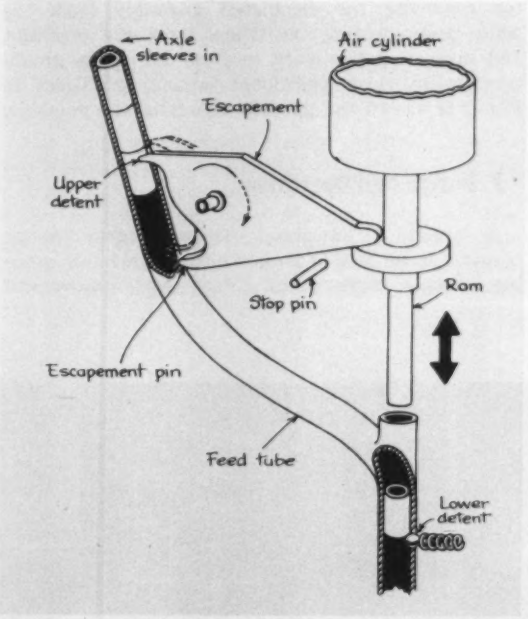


Fig. 5—Axle sleeve placing mechanism receives parts from vibratory hopper on the machine base. When initial sequence begins, the air-actuated ram descends, rotating the escapement, and the upper detent is retracted. This allows sleeves to drop in the feed tube until the bottom of the first sleeve is stopped by the projecting escapement pin. Return of the ram restores the escapement to its original position, freeing the first sleeve and clamping the second sleeve via the upper detent. The first sleeve drops to the bottom of the feed tube where it is held by the lower detent pin. Next descent of the ram forces the first sleeve into the work nest and re-actuates the escapement.

feeders to standardized placing mechanisms adapted to suit the piece parts. Feeders with 24-inch diameter bowls were developed for the three largest components, the tire and upper and lower webs. In view of the requirement for smooth travel of the carriers and freedom from extraneous vibration, particularly in the area between ball-feeding Stations 4 and 10 and their succeeding operations, it was decided to isolate the large vibratory feeder units from the machine base. Accordingly, these are mounted on top of a large auxiliary rack at the rear of the machine and parts are channeled to the appropriate stations via tracks.

The rack which supports the large vibratory units serves another purpose; its structure includes six separate bulk parts bins and elevator-conveyors which lift and distribute parts to all of the vibratory feeder bowls, including the three small units mounted on the machine base. Each elevator-conveyor, *Fig.* 4, includes an endless belt which passes along the face of a vertical metal panel. Affixed to the panel on the side away from the belt are a series of magnets. By reason of the attractive force of the magnets acting through the belt, and the upward motion of the belt, the steel parts are lifted from the bulk parts bins to receiving chutes above. Level switches associated with the vibratory feeders actuate the elevator-conveyors on demand. When supplies are replenished, the elevator-conveyors are stopped automatically.

Unless adequate safety provisions are incorporated in the design of an automatic assembly machine there is always a possibility that an out-of-tolerance part will cause a machine jam and in some cases damage the tooling. All stations of the skate wheel assembly machine are protected by electrical interlocks working through a standard Ferguson control panel. If any station fails to function properly and the tooling does not clear the nest prior to indexing, the machine will stop. Manually-operated emergency stop buttons are also available at different locations on the machine.

▸ Off-the-Shelf

This installation serves as an excellent example of the use of standard components in the fabrication of special-purpose production machines. Actually, the Trans-O-Mator machine base was an "off-the-shelf" item which had been constructed previously and held available for a suitable application. Certainly, the bulk storage-magnetic elevator-conveyor assembly is adaptable for countless applications involving the handling of steel parts. The ball-feeding station, *Fig.* 6, the dust shield feeding and placing mechanism, *Fig.* 8, and the work nest inspection station, *Fig.* 9, all are adaptable in principle to other parts and other machines.

It is through the development and employment of standardized methods and tooling such as those described here that the conversion to automatic assembly will become more practical for a larger number of firms and for a greater variety of products. In some cases it may prove to be the salvation of manufacturers who lack the capital and personnel to enhance their competitive standings through extensive development of their own automatic equipment.

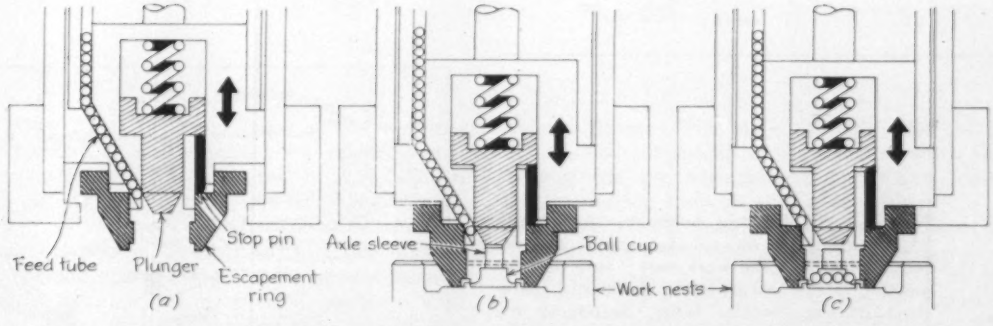


Fig. 6—Ball-feeding mechanism as used at Stations 4 and 10. Balls drop from hopper by gravity into ten circumferentially spaced feed tubes and are conducted around the plunger. *(a)* Shows position of the feeding head prior to actuation by air cylinder. Balls are retained in the tubes by the plunger. *(b)* The escapement ring has bottomed on the work nest, the plunger motion has been stopped by the stop pin, and continued movement of the feed tubes has caused a shoulder of escapement ring to enter slots in the feed tubes and prevent dropping of the balls second in position. *(c)* Feed tubes have bottomed, developing clearance around the plunger so that the first ball in each tube can drop in place in the work nest.

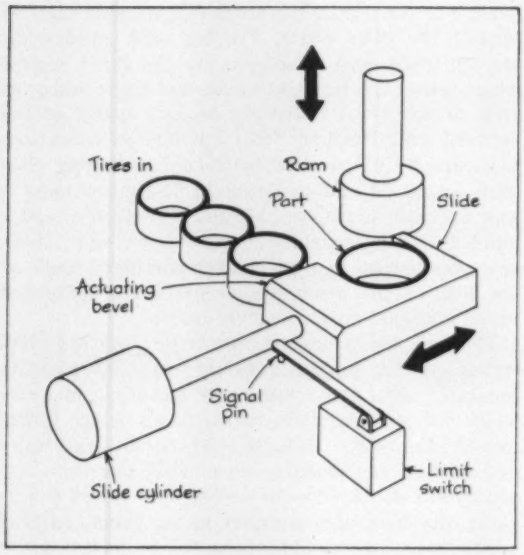


Fig. 7—Tire placing unit locates part under ram by reciprocating action of slide. When tire reaches position under ram, ram cylinder acts to push it into the work nest. Ram retracts, slide returns to its starting position, and another part is engaged. Signal pin actuates a limit switch to stop machine if slide fails to return.

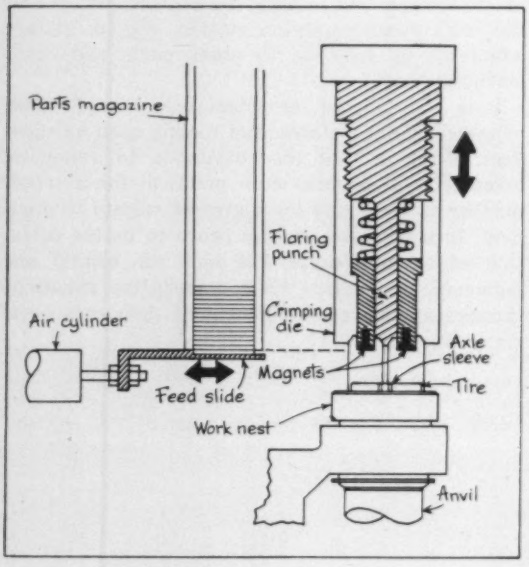


Fig. 8—Simplified sketch of the mechanism at Station 12 which feeds and positions the dust cover, flares the axle sleeve and crimps the tire in one operation to complete assembly of skate wheel. Dust cover pushed into position under ram by air-operated feed slide is picked up by magnets. Feed slide retracts, hydraulic cylinder lowers the ram, and assembly is completed.

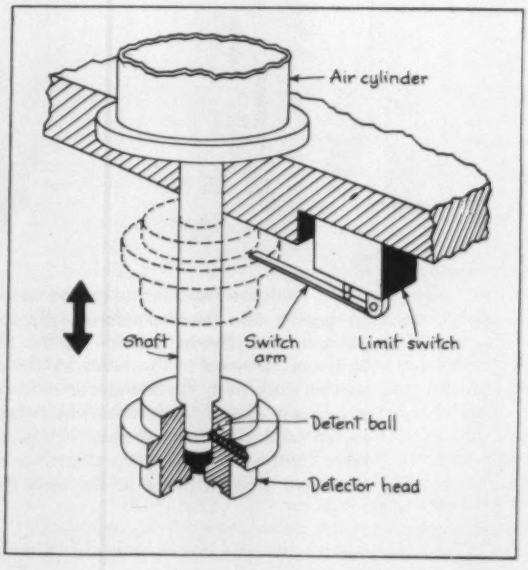
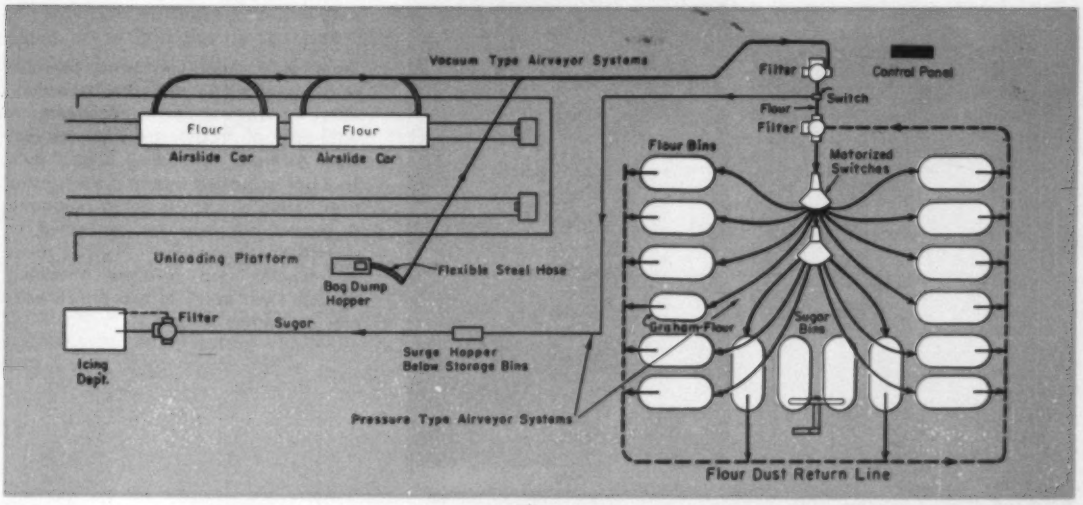


Fig. 9—In the probing mechanism for Station 15, actuation of air cylinder lowers the detector head into the work nest. Any part remaining in the nest stops the downward movement of the detector head, dislodging the head from its normal position relative to the end of the shaft (note detent ball). When the cylinder retracts, a shoulder on the displaced head trips a limit switch, stopping the machine. The detector head is reset when the cylinder is fully retracted.



1 Diagram of pneumatic handling systems for flour and sugar unloading and transfer at Philadelphia plant of National Biscuit Co. Unloading operations are accomplished at the first floor. Flour is conveyed from bulk car through flexible steel hoses into vacuum type Fuller Airveyor system, and through a switch that connects unloading line to a pressure type Airveyor system. Delivery to storage bins on eighth floor is accomplished at rate of 20 tons per hour. Panel controlled motorized switches direct delivery to selected bin. Pressure system is used alternately to convey sugar from surge hopper below bulk storage bins to a "use" bin in icing department.

AUTOMATION TODAY

HANDLING AND PROPORTIONING IN

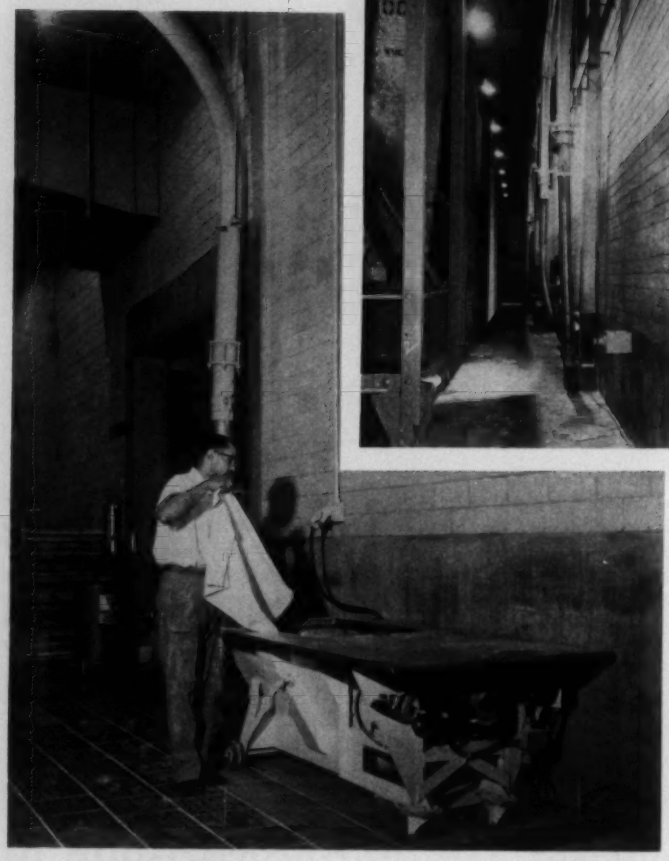
BAKERY AUTOMATION

A NEW LARGE bakery plant of the National Biscuit Co. has a production schedule calling for the manufacture of 118 million pounds of Nabisco cookies and crackers a year, including 45 different varieties in more than 20 different packages. Production facilities include seven traveling-band ovens, 19 high-speed mixers, and an integrated packaging line complete with automatic forming, filling, weighing, sealing and wrapping machines. A network of transportation facilities, including over 100 special freight cars and hundreds of trucks, maintains a continuous flow of incoming raw materials and outgoing finished products to a 19-state market.

All facilities for storage, transfer, sifting, proportioning, and delivery of ingredients to production ovens are housed in an eight-story tower. Following pneumatic delivery of flour to bins on the eighth floor, flow lines for ingredients are vertical, with different operations handled on different floors: fifth floor, feeding and sifting; fourth floor, weighing of ingredients; third floor, mixing and the beginning of production baking; and packaging lines on the second floor.

This is not the first time Nabisco has used this type of tower but the company considers it the most advanced application it has made of such a layout. The extended use of control panels for unloading and proportioning operations combines automatic, labor-saving operations with the high degree of control that is essential to the plant operation.

Several reasons are cited for inclusion of the tower design in planning new bakeries. It permits compact layout and interlocking of storage elements with conveyors, hence a high degree of automation. It saves valuable ground space, with handling operations stacked on top of one another instead of spread out horizontally. And two men can control millions of pounds of materials flow-

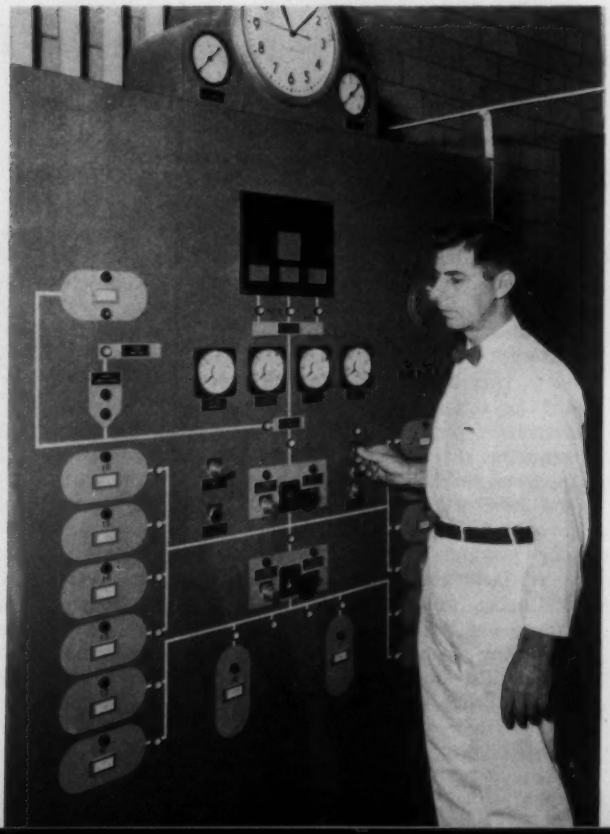


2

Train shed unloading area contains two sets of tracks that can accommodate three cars each. Adjacent to one pair of tracks are two vacuum type Airveyor unloading lines. Bulk cars are unloaded one at a time; however, while one car is being unloaded a second car may be connected to second pneumatic line. Hookup takes 45 minutes and involves attaching flexible steel hoses to two 6-inch nozzles at bottom of car.

3

Adjacent to other pair of tracks is platform at which bagged ingredients are unloaded from cars. Portable bag dumper hopper is connected to an Airveyor unloading line. Operator is shown emptying graham flour which is being conveyed through vertical line behind him to storage bin on eighth floor. Flours used in small quantities are delivered in railroad cars in 100-pound bags. It takes four to six hours for four men to unload an 800-bag car.



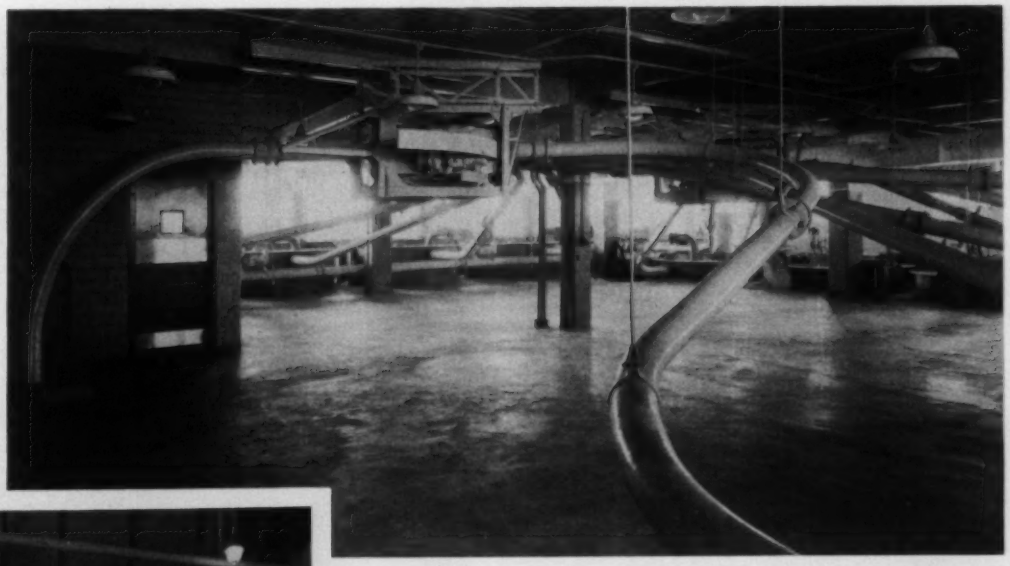
4

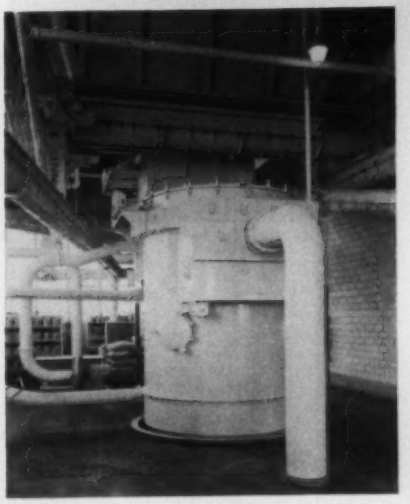
Control panel for pneumatic handling systems is located in separate room at rear of train shed. After connecting lines to car, operator goes to panel to set up bin selection in accordance with type of flour being handled. When pipe switches assume proper position, butterfly valves position automatically to set up corresponding flow for dust return lines. Then operator pushes *Start* button. Graphic representation of bins and conveying lines simplifies setup operation.

ing through storage and handling facilities by means of control panels that interlock the entire operation.

The system that transports incoming flour from receiving dock to storage and the system that proportions ingredients and delivers them to in-plant mixers are described in the accompanying photos. The first, for unloading and storage of different flours into any of the 14 giant bins was manufactured and installed by Fuller Co., a subsidiary of General American Transportation Corp. The second system, controlling all feeding, conveying, sifting, proportioning, and delivery of ingredients to mixers, was supplied by Richardson Scale Co.

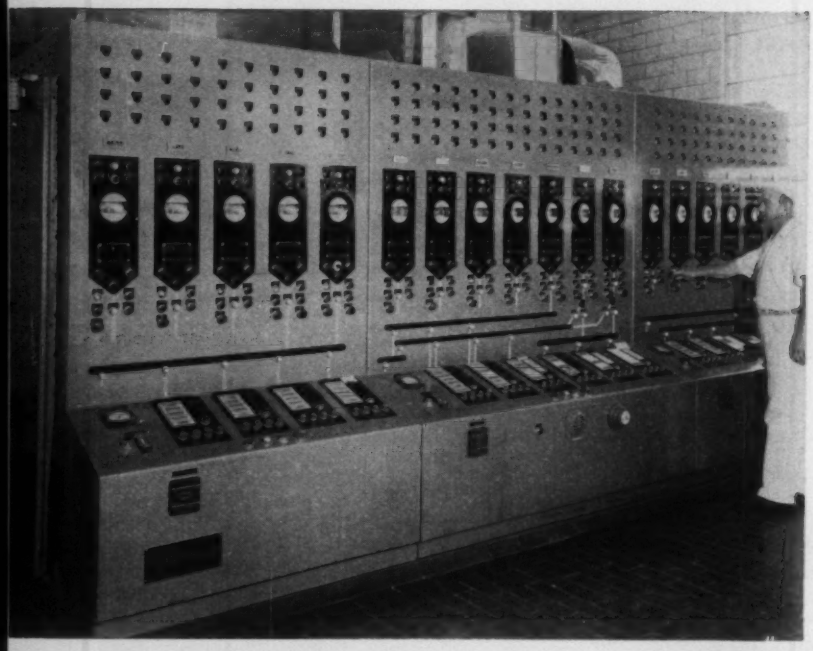
5 Flour from first floor unloading area arrives at eighth floor in pipeline shown at left and enters first motorized switch. Position of switches is controlled from setup on panel board.





6 Lines lead from switches to fourteen multistory bins whose tops are at eighth floor level. When a bin is full a high-level bin indicator actuates a horn on the control panel. At signal operator stops flow of material. Lines then clean themselves and system shuts down automatically.

7 Dust filter unit located between fourth and fifth floors receives flour dust exhausted during a bin filling operation. Flour is collected and returned to bin. Filter is 6 feet 9 inches in diameter, and contains four compartments. Each compartment is equipped with a cast iron manhole frame and hinged cover which may be opened without using a wrench. Filter tops are removable in quarter sections without disturbing timing gears or shaking mechanism.

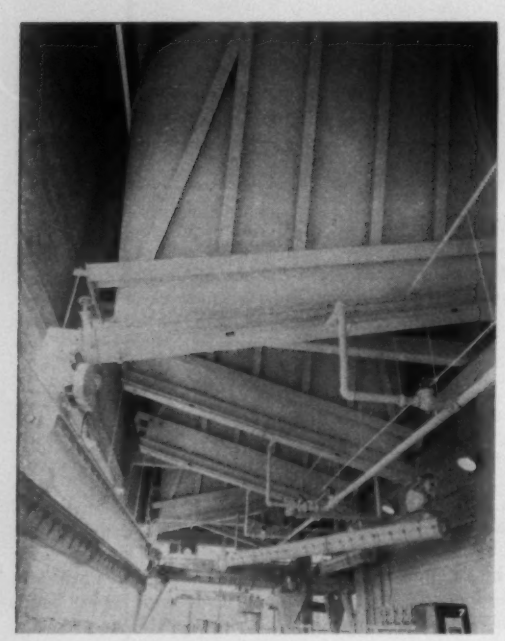


8

Three-section control panel is heart of Select-O-Weigh proportioning system supplied to Nabisco by Richardson Scale Co. Setups made here provide for feeding of material from flour and sugar storage bins and from storage tanks for shortening, invert, molasses, and water. Each section on the panel ties in a series of material feeders and automatic scales with a group of mixers. With one formula setup per section, three different formulas can be proportioned simultaneously. Ingredients are delivered in the sequence and proportions called for by the panel, which indicates every phase of the material flow operations by means of graphically arranged signal lights.

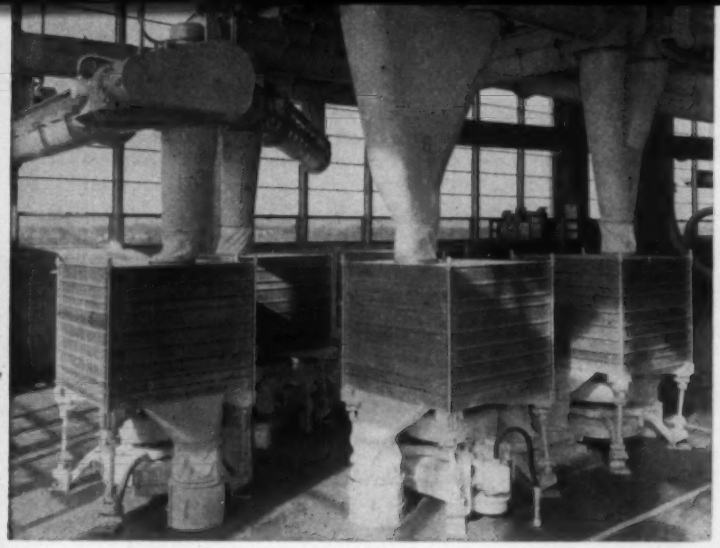
9

Because Nabisco normally runs only one formula through any one mixer during a single shift, weight selector dials were mounted inside the walk-in section of the control panel and not on its face. Three dials for each of 18 scales permit three different formulations to be handled by each scale. Shop foreman is shown making settings to be used during his shift. Technique eliminates misformulation through faulty weight selection and enables panel operator to run formulas more quickly.



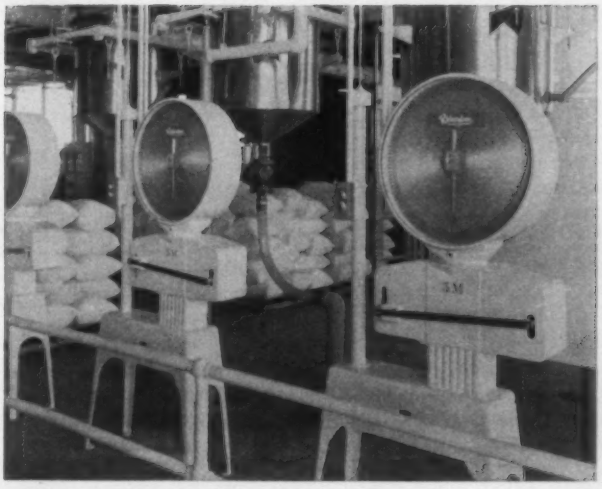
10

Fifth floor view of multistory bins from underneath shows Fuller-Huron Airslides that convey flour from storage. Other conveyers carry flour to sifters, scales, and finally to mixers. Actuation of discharge of ingredients from the storage system is initiated by control panel.



11

Flour conveyed from storage bins is automatically sifted and discharged through the floor to automatic weighing equipment on the fourth floor.

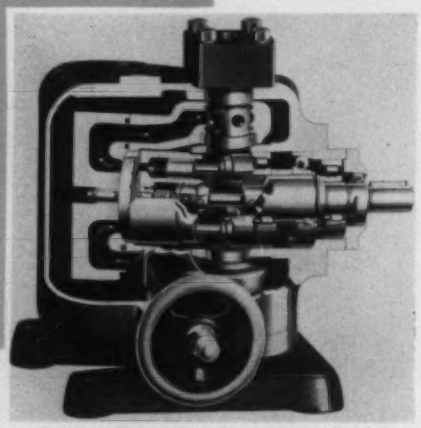


12

Dry ingredients are weighed in one of 14 *weigh-in* scales—4 *weigh-out* scales handle liquids. Weights are indicated on scale dials shown and also remotely registered in magnified "bull's eye" indicators on face of panel, *Fig.* 8. At completion of weighing cycle, ingredients are discharged to paddle type Poly-Plane conveyer which delivers them to prescribed mixer.

13

End point of the automatic proportioning system is battery of 16 mixers. Panel on each mixer provides communication between mixer operator and central proportioning control panel.



Courtesy, Vickers Inc., Div. of Sperry Rand Corp.

Fig. 4—Axial piston, variable delivery pump. Adjustment of handwheel changes angle between piston driveshaft and cylinder block to control displacement. Unit shown delivers oil at pressures to 3000 psi.

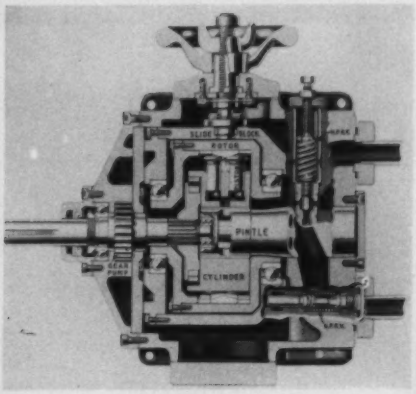
This second part of a series covering the synthesis of hydraulic control systems from commercially available components presents some of the more important criteria in the selection and evaluation of pumps and actuators.

Hydraulic Control of Automatic Machinery

SYNTHESIS OF SYSTEMS . . . 2

SELECTION AND EVALUATION OF HYDRAULIC PUMPS AND ACTUATORS

By R. HADEKEL
Engineering Mgr.
Sunbury Div.
Sperry Gyroscope Co., Ltd.
Brentford, England



Courtesy, Oilgear Co.

Fig. 5—Sectional view of a radial piston, variable delivery pump. In this unit, delivery is adjusted by changing eccentricity between slide block-rotor assembly and cylinder block. The gear pump in the end bell at left provides pressure for operating hydraulic controls and for supercharging the system.

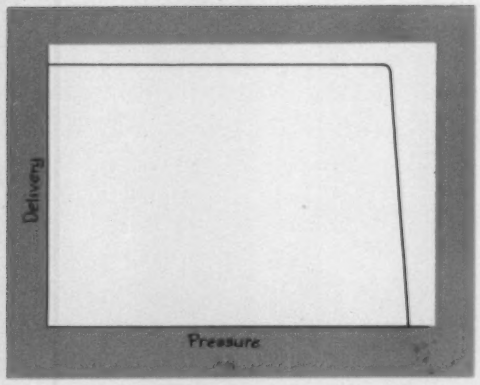


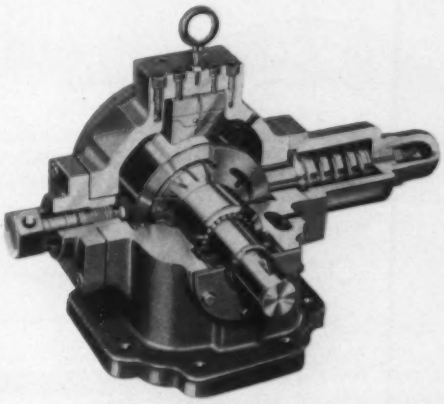
Fig. 6—Curve illustrates effect of maximum pressure control on output of variable delivery pump. Delivery remains at peak until maximum design pressure is reached, then falls sharply to zero.

EVALUATION of pumps from catalog data is a tricky business. Indeed, a really fair assessment of the merits of any particular design is virtually impossible short of a full evaluation by means of laboratory tests, since even the most comprehensive catalogs necessarily give only a fraction of the required details. Laboratory evaluation however is not often practical, and a few guiding principles may therefore be in order.

Generally speaking, it is well to beware of jumping to conclusions based on the general type of pump. For instance, a judgment such as "rotary pumps are no good above 1500 psi or thereabouts" may be completely invalidated by certain detail refinements in the design of one particular pump. This may or may not have been brought out in the manufacturer's description.

Care spent in the study of detailed constructional features often reveals differences in quality among similar units. Features to look for are those making for good lubrication and favorable contact for working surfaces. Accurate alignment of parts both initially and under load is important. Designs which would seem to require unusually high manufacturing accuracy should be examined very critically, and the user may well be advised to satisfy himself that the manufacturer has in fact got his precision manufacturing problems well under control. This can usually be taken for granted when the firm is of good repute.

Unorthodox constructional details, if they clearly serve a good purpose, may be evidence of good design. Unorthodox pumping principles, to the author's mind, are less often praiseworthy. They are not infrequently the subject of unwarranted advertising claims. The established basic pump types—piston, gear, vane, and their variants can, if well designed, give excellent service. A very strong case should be made to justify a radical departure from these. For example, claims are made for some unorthodox designs that they provide ripple-free flow, but this feature is found in certain vane pumps and in some variants of the gear pump. Actually, in the majority of applications to automatic machines the presence of moderate ripples is unimportant.



Courtesy, Racine Hydraulics & Machinery, Inc.

Fig. 8—Delivery can be increased or decreased on this vane pump by changing the eccentricity between the rotor and the pressure ring. Spring governor automatically maintains constant pumping pressure.

The performance curves contained in catalogs should be scrutinized. In most cases the volumetric efficiencies shown are based on comparatively low operating temperatures in the neighborhood of 30 to 40C. However, in many hydraulic installations it may be desirable to allow the temperature to run up to 60 or 70C for the sake of eliminating a cooler, or to minimize its size and cost if one is to be used. Volumetric efficiency is seldom a problem with piston pumps, but with gear, vane and similar types it can often drop to absurdly low figures at elevated operating temperatures. The primary cause of the efficiency drop is the decrease of oil viscosity with rising temperature. Its effect is more pronounced with smaller pump sizes. For this reason, efficiency figures for the highest temperature contemplated should be obtained.

Overall efficiency is the ratio of driving shaft power to the hydraulic power delivered. Some of the input power is spent in pumping oil which leaks back to suction. More is dissipated in the flow to tank through a separate leakage return line when this is provided. The rest of the power loss is spent in oil churning (usually a low figure), in overcoming viscous drag of rotating or reciprocating parts, and in overcoming boundary friction. The latter is friction between surfaces which are not lubricated in the sense of being separated by an oil film of appreciable thickness. The power lost in these processes (i.e., all losses except those associated

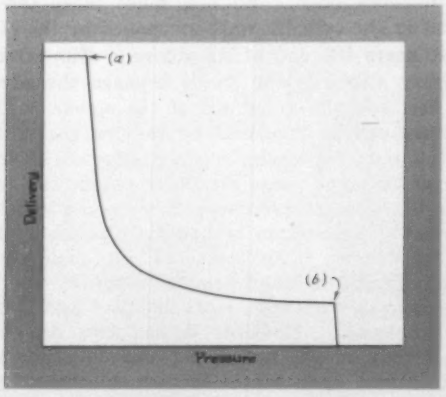


Fig. 7—Under constant power control, output of variable delivery pump varies inversely with pressure after small initial buildup of pressure to *(a)*. Overriding maximum pressure control takes over at *(b)* to hold pressure to a safe value.

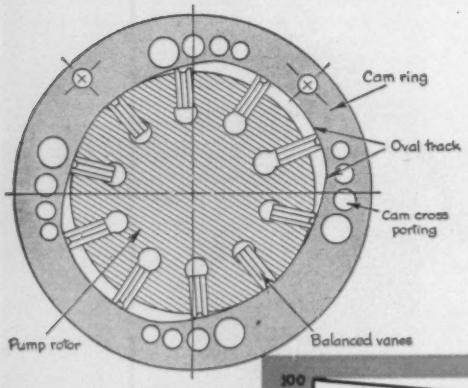
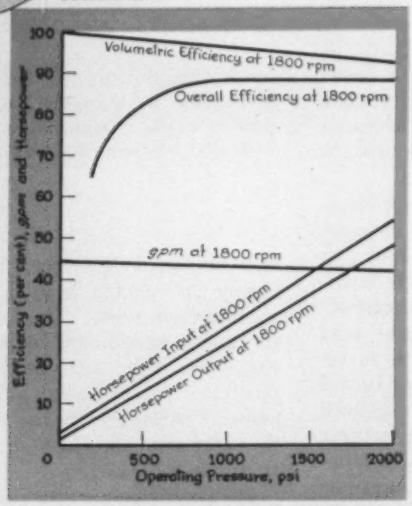


Fig. 9 — Cross-sectional diagram of fixed delivery vane pump illustrates oval track design which balances out radial bearing loads. Operating characteristics for a 2000 psi unit are shown at right.

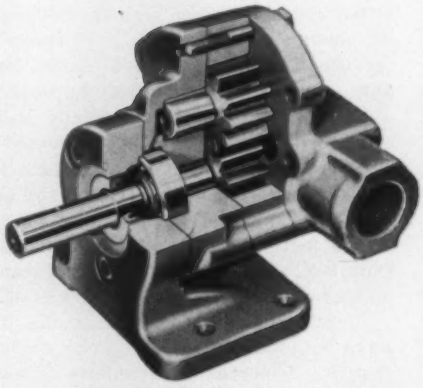


Courtesy, Denison Engineering Div., American Brake Shoe Co.

up to 1500 psi are currently available, and higher operating pressures are claimed for some. Where variable delivery is required the piston pump is usually specified, but it should not be forgotten that variable delivery vane pumps also are obtainable for moderate pressures. Again it should be cautioned that firm judgments of this sort are always liable to be invalidated by improved design of any particular type.

Piston pumps with check valves for both suction and delivery are commonly used for very high

Fig. 10—Cutaway view shows construction of a typical external spur gear pump.



Courtesy, Adel Precision Products Corp.

with internal leakage) is shown by the mechanical efficiency figure, which is not often given directly in manufacturers' published performance curves. However, this may simply be found by taking the ratio of overall efficiency to volumetric efficiency, both of which are usually quoted.

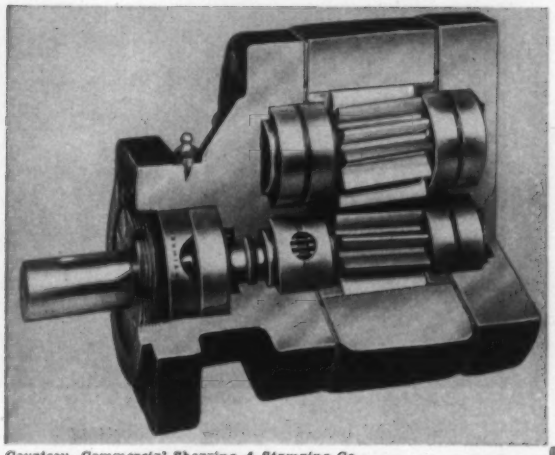
In many cases the principal part of the mechanical loss is that associated with boundary friction which in turn is a major cause of wear. Hence, if no other data are available, mechanical efficiency may sometimes be used for a rough estimate of pump life. It must be emphasized, however, that this is an extremely crude criterion, all the more so because not all wear is equally correlative to durability. For instance, in a vane pump, wear of the vane tips may be inconsequential because of the self-adjusting feature of the blades, while wear of the track is virtually irremedial and may be serious.

▶ Pump Types and Uses

In general, piston pumps are usually reserved for relatively high pressure applications (above 2000 psi) because of their higher cost as compared with rotary types. Of the other two main types, vane pumps are on the whole slightly cheaper. Both gear and vane pumps suitable for pressures

pressure applications (6000 psi and more). Another type of piston pump employs check valves for delivery only. Suction takes place through a slot in the cylinder wall, unmasked by the piston as it nears the end of its stroke. The effective delivery stroke is the travel between the edge of the slot and the other end of the stroke. Thus, delivery can be regulated by varying the position of the slot; for example, by sliding the cylinder. In use for many years for Diesel engine fuel injection, this type of variable delivery pump is finding increasing application to hydraulic power systems for machinery. As compared with variable delivery pumps of the variable piston stroke type it is probably cheaper, more compact and at least as efficicent. However it has two drawbacks which may or may not matter, depending upon the application: first, ripple intensity increases with decreasing delivery; and secondly, delivery can be reduced to zero but cannot be reversed.

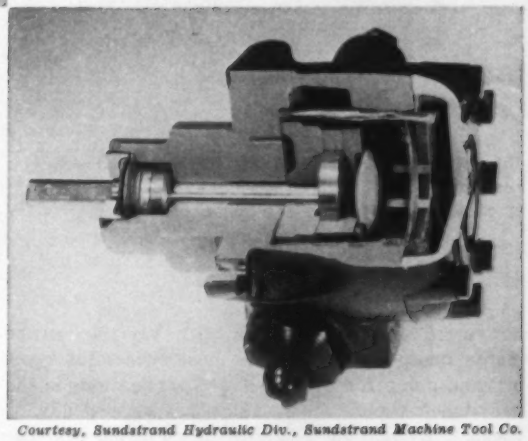
The usual type of variable delivery pump for hydraulic actuation of machines employs a variable piston stroke arrangement. There are two main



Courtesy, Commercial Shearing & Stamping Co.

Fig. 11—Helical gear pumps feature relative quietness of operation, can give nominally ripple-free delivery.

Fig. 12—Internal gear pumps are more compact than external gear types. Unit shown has integral relief valve and strainer, delivers oil at pressures to 300 psi.

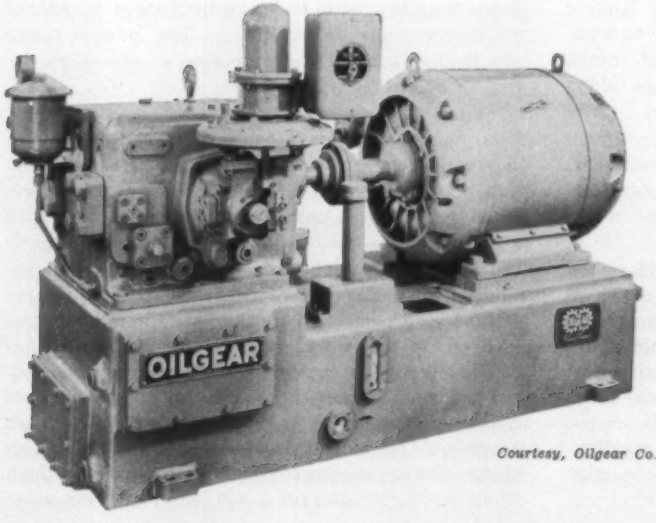


Courtesy, Sundstrand Hydraulic Div., Sundstrand Machine Tool Co.

versions of this: the axial piston type in which stroke is controlled in some models by varying the inclination of the cylinder block with respect to the piston driveshaft, *Fig.* 4, and the radial piston type, *Fig.* 5, in which stroke is controlled by adjusting the eccentricity of a track with respect to the cylinder block. The block, incidentally, rotates in both cases. The author does not believe that one type is inherently better or worse than the other, and holds the view that what really matters are the details of each design.

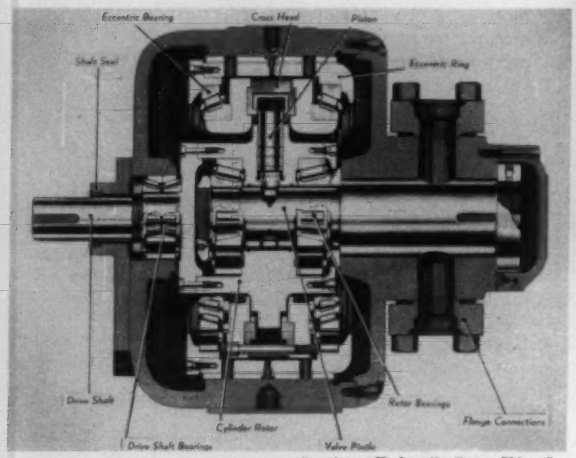
Variable delivery pumps are usually offered with a choice of controls. The usual ones are: maximum pressure control, *Fig.* 6, in which delivery remains at peak until maximum pressure is reached, then falls off to zero fairly sharply; and constant power control, *Fig.* 7, in which from a certain point onward delivery varies inversely with pressure. Overriding maximum pressure control may also be provided by manual control at the pump or by remote control. The latter may be manual or automatic, as by cams on the machine to be actuated. The applications of these types of control will be discussed in a forthcoming section of this article series.

One of the simplest of vane pumps is that in which the vane tips bear on an eccentric track, *Fig.* 8. By altering the eccentricity, delivery can



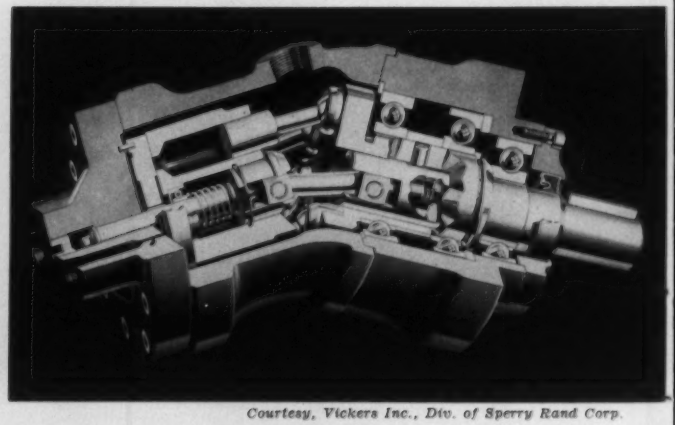
Courtesy, Oilgear Co.

Fig. 13—Pumping unit includes two-way variable delivery pump with pneumatic actuator for servo control, electric drive motor, base tank, suction filter and high pressure relief valve.



Courtesy, Hydraulic Press Mfg. Co.

Fig. 14—Radial piston, variable displacement motor converts hydraulic power to rotary mechanical power of adjustable torque and speed of rotation.



Courtesy, Vickers Inc., Div. of Sperry Rand Corp.

Fig. 15—Axial piston, constant displacement hydraulic motor delivers power proportional to rpm with a given operating pressure.

be varied and reversed, as with variable stroke piston pumps. One of the most successful types of vane pump for fixed delivery applications is the oval track type, *Fig.* 9, which has several advantages. By making a portion of the track near the minor and major axes concentric with the axis of rotation, the vanes are kept fixed over the critical portions of the cycle, and nominally ripple-free delivery is effected. Also, radial loads on bearings are theoretically zero and delivery per revolution is doubled.

The most common type of gear pump is one employing external spur gears, *Fig.* 10. Clearance at the gear sides is critical (as indeed is rotor side clearance in vane pumps), and to overcome the problems associated with side clearance control some manufacturers use pressure plates hydraulically loaded against the gears. This of course only deals with one leakage path; leakage along tooth crests can also be quite important. The author is inclined to think that the effect of pressure plates on mechanical efficiency is undesirable. This however is a theoretical consideration, and the pumps concerned must be judged on the performance achieved.

A few pumps have helical gears, *Fig.* 11 which may be helpful in reducing noise level. There is a widely held belief that the use of helical gears in itself prevents trapping of oil, but this is incorrect unless very special tooth profiles are used. In any event trapping is not a fundamental problem, and is usually dealt with by reliefs in the casing sides or by modifications to tooth profiles. Helical gear pumps can also be made to give nominally ripple-free delivery.

Another type of pump, sometimes referred to as a "screw pump", is really an axial flow helical gear pump. It also can provide ripple-free output. Several manufacturers offer internal gear pumps, *Fig.* 12, although they are not necessarily described by that name. These are more compact than external gear types, and perhaps cheaper, but pressure ratings are somewhat lower.

Pumping Units

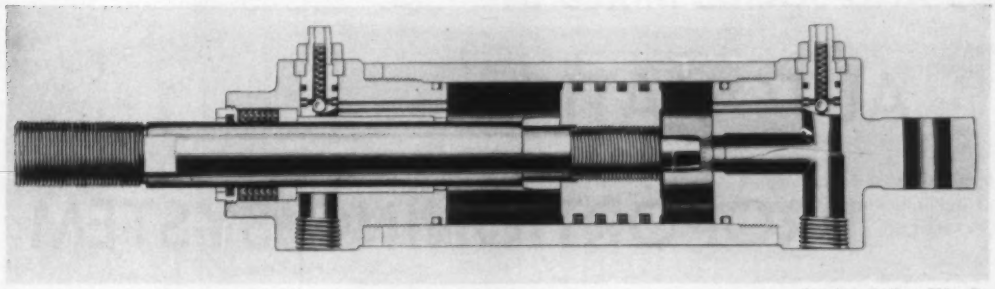
Many manufacturers will supply pumping units, *Fig.* 13, which consist at the very minimum of a pump, an electric drive motor, a base tank, a suction filter and a relief valve. The relief valve may be supplemented or replaced by some form of unloading device, for example an automatic cutout, in which case an accumulator may also be fitted to the unit. Twin pump units are also available, either as components or as parts of larger units. They usually consist of a large and a small capacity pump together with an unloading valve to unload the larger pump as required. The smaller pump usually has a relief valve or similar unloading device.

Twin pump units may be used in two ways. For quick-approach systems, where the problem is to complete a certain operation in the minimum time compatible with a limited power consumption, the larger pump is unloaded when pressure reaches a certain value well below the system maximum. The smaller pump then applies the full load at reduced speed. For systems where there is no clearly defined approach travel, the large pump can be used to do the work until it reaches a pressure just below system maximum. It is then unloaded, and the small pump takes over for the purpose of maintaining pressure in the system while the main pump is off load. In this way, heating of the oil and idling power requirements are reduced. Such ready-made pumping units are used wherever prac-

ticable in order to reduce both design and manufacturing work on the system installation.

Other Components

The construction of hydraulic motors, *Figs.* 14 and 15, broadly follows that of pumps, except that check valves cannot be used for suction or delivery. It is, however, rather more difficult to achieve high mechanical efficiency from a motor than from a pump—which is the reason why the majority of pumps cannot be used as motors—and the output torque at starting may be significantly lower than the running torque. If these considerations are of special importance, detailed performance data should be obtained from the manufacturers.



Courtesy, Pathon Mfg. Co.

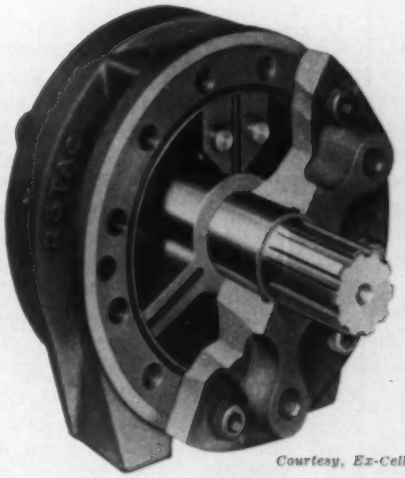
Fig. 16—This hydraulic cylinder has step-cut cast iron piston rings for maximum service life. Soft seals may be specified for zero-leakage applications, but service life is shorter.

One of the chief attractions of hydraulic actuation is the ease of exerting high loads at low speeds by means of cylinders. A very wide range of hydraulic actuating cylinders is now available, allowing good choice not only in respect of sizes but also as regards type of mounting. Stroke can usually be specified by the purchaser. Chromium-plated piston rods can be obtained, the specifying of which should be well justified in most cases by longer life. For outdoor applications they are an obvious choice anyway, on the score of corrosion resistance.

Most manufacturers offer as an optional alternative cast iron piston rings, *Fig.* 16, instead of the more usual soft seals, on the piston. Precise data are lacking, at least as far as the author knows, on the relative merits of piston rings and soft seals, but there are grounds for believing that piston rings are more reliable and last longer. They do, however, allow some small amount of internal leakage, which could be significant in applications calling for hydraulic locking. Piston rings also give rather lower friction than soft seals.

Cylinder friction can be quite high, and should be allowed for when calculating the required size. Manufacturers should certainly be able to provide data on friction at no load, but friction while under pressure can easily be ten times higher, and unfortunately data on this subject are sadly lacking. The author, in tests, has measured values ranging from 10 to 50 per cent of peak load on different cylinders; the latter figure of course represents an extreme case. Percentage figures tend to be higher for small than large cylinders, and may vary considerably as between different types of seals. The author would estimate the figure $0.2pA$ to be a very rough indication of the order of magnitude of the frictional drag force in pounds, p being the pressure in psi and A the area in square inches of seal in contact with cylinder or rod. To this figure should be added the initial friction. The result, however, may be wide of the mark in some cases.

Rotary actuators, *Fig.* 17, are available for special applications. They differ from hydraulic motors in that they exert a high torque over a limited range of travel, always less than one revolution and in some models less than one half. They are therefore the true rotary equivalent of the linear actuating cylinder. Leakage is usually appreciable. Actuators of the rotary type are listed by a few firms, and their use may sometimes be very convenient.



Courtesy, Ex-Cell-O Corp.

Fig. 17—Rotary actuator operates through a 280-degree arc, provides high torque at output shaft.

Third part of this series, to cover automatic-acting and external-control valves, will appear in the December issue.

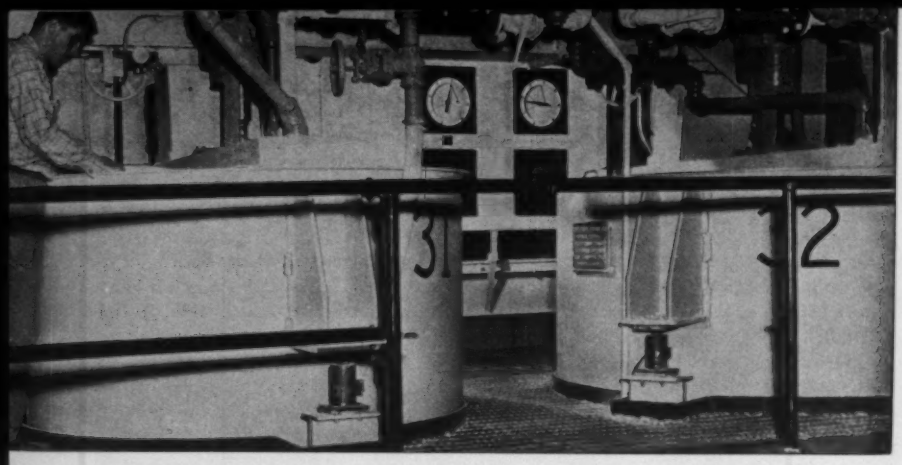


Fig. 1—View of mixing tanks in which coating materials for fabric wall covering are automatically formulated. Controls on wall at rear determine quantities of major ingredients to be added to tanks and time mixing cycles.

LIQUIDS AND SOLIDS MIXED BY

AUTOMATIC PROPORTIONING SYSTEM

AUTOMATIC proportioning of ingredients for the plastic coating material applied to Super-Sanitas fabric wall covering has enabled Standard Coating Products Co. of Buchanan, N. Y., to increase production of an improved product at less cost. The new installation, *Fig.* 1, uses a Baldwin-Lima-Hamilton Corp. system to control the weight of the liquid and solid coating ingredients that flow into 1000 and 1500-gallon tanks. It has greatly reduced the amount of laboratory analysis required, while increasing the efficiency of production and uniformity of quality of the large batches required to meet increasing demands.

Weight transducers, the heart of the system, are three precision-type Baldwin SR-4 load cells of 10,000-pound capacity each, *Fig.* 2, on which the tanks rest. Operating on the principle of the bonded resistance wire strain gage, the cells are connected to give remote electrical indication and recording of weight as well as actuation of the controllers which govern material flow.

Instrumentation includes five timers by which the duration of each mixing cycle is set. Weighing and mixing proceed simultaneously and independently in response to electrical signals from the load cells and the timers. These control the opening and closing of valves in three feed lines of the liquid products flowing into the mixing tank, the starting and stopping of a conveyor which carries pulverized clay into the tank, and starting and stopping of mixing action in accordance with the preset time schedule.

Preparing Batches

Materials are mixed in two different batches; three of the major ingredients in one batch and two in the other. The instrumentation is set up to handle either batch automatically as determined by the setting of a two-position switch. The major ingredients in one batch are water, a resin and pulverized clay. The other batch is a mixture of water and latex plus small quantities of other ingredients. Seven other ingredients of the two mixes are added manually. These total only about five per cent of the total mix and vary in quantity depending on the ingredient.

Preparation of a batch is begun by pressing a *Start* button. A valve in the water line then opens and water flows into the mixing tank until the load cells signal the controller that the proper weight is in the tank. The water valve then closes automatically and two further actions take place simultaneously; the valve in the resin line opens and a Patterson Unimixer starts. Mixing is done by a vertical, motor-driven shaft with vanes at the bottom. Mixing action is automatically stopped before the resin flow is stopped in order to prevent churning action from affecting the weight measurement of the resin being added.

When the resin line valve closes, two more actions take place simultaneously; the conveyor starts feeding pulverized clay into the tank and the mixing action resumes. Again the mixer is automatically stopped while the clay continues to flow

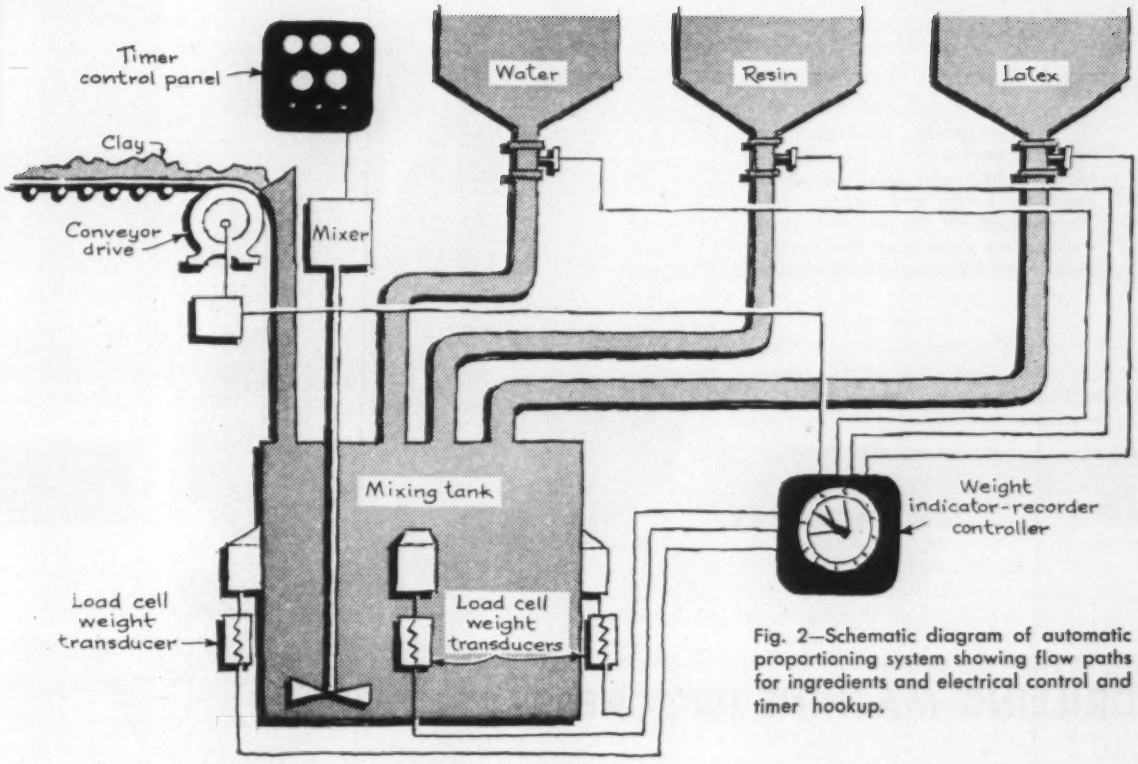


Fig. 2—Schematic diagram of automatic proportioning system showing flow paths for ingredients and electrical control and timer hookup.

into the tank. When the load cells indicate that enough clay has been added, the conveyor is stopped automatically and mixing is started again. At this point the electrical control circuit is actuated in such a way that the discharge valve cannot be opened while the mixer is running. After a 30-minute mixing cycle the mixer stops and a signal lamp is lighted. The discharge valve is manually opened to discharge the completed mix by gravity into a storage tank below. Electrical interlocks prevent the *Start* button from actuating the equipment again until the discharge valve is closed after the tank has been emptied.

The other batch, consisting of a mixture of water and latex with other ingredients in minor quantities, is prepared similarly. Normally the two batches are mixed in different tanks, but each tank and instrumentation system is set up to produce either batch.

Accuracy of all ingredient proportions is held within one-half per cent. All liquid ingredients flow through 2-inch pipes and the clay flow on an enclosed conveyor is at the rate of about 5½ pounds per second. Weights being measured range from about 3000 pounds for the empty tank to about 18,000 pounds total for the largest batch. The system is designed to stop and start again at the same point in the event of a power failure, continuing the cycle from the stopping point after a short warm-up of the instrument. A limit switch prevents actuation of the controls while the tank is being discharged and weight is falling below the amounts for normal actuation. After the *Completed* lamp is lighted, the cycle cannot be repeated until the tank has been discharged, the discharge valve closed, and the *Start* button pushed. The system is arranged in such a way as to permit manual operation also. Each feed line has a meter to indicate the volume of material flowing into the tanks, so that figures indicated by the flow meters may be compared with quantities measured by weight.

The use of automatic batching in the production of SuperSanitas contrasts with methods used in making this fabric wall covering during the 43 years since its introduction. During the first 40 years, when the coating material was made with linseed oil, quality control required manual production in 50-gallon batches under laboratory control for each batch. When the latex type coating was introduced batch quantities were increased to 400 gallons and ingredients were still measured manually by weight on platform scales. As quantities were increased and more efficient production methods developed, it was found advantageous to meter some of the liquid ingredients directly into the batch tank. Since the production of larger batches improved both the efficiency of production and the uniformity of the product, still bigger batches were found to be desirable. The Baldwin system offered a simple means of handling the larger bulk and fluid ingredient requirements, providing the repeatability of measurement required for product uniformity, and permitting automatic proportioning of ingredient quantities.

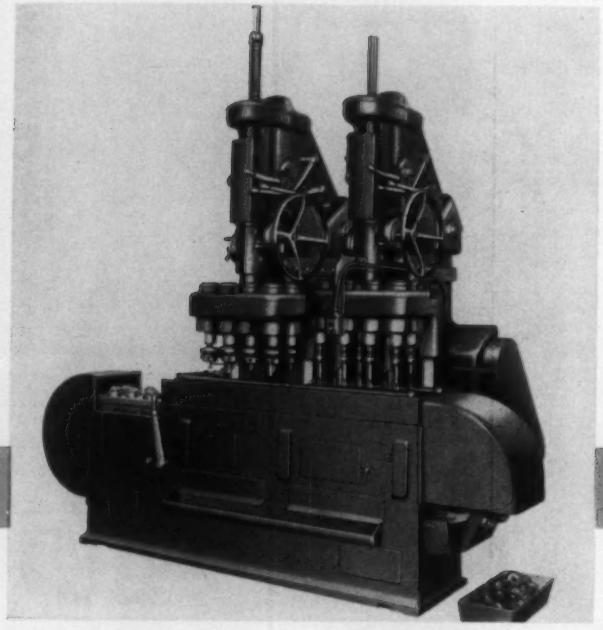


Fig. 1—Two-spindle production unit has continuous conveyor type indexing table to carry parts under multispindle heads for boring and tapping. Parts are dropped off the conveyor as the workholders pass over the sprocket at the right hand end of the machine.

DRILLING MACHINE PROGRESS HIGHLIGHTS

EVOLUTION INTO AUTOMATION

By **RUDY PURICELLI, Jr.**
Barnes Drill Co.
Rockford, Ill.

COMBINING of tools, machines, parts, materials, setups, and fixtures provides automation of production operations involving machine tools. Since one of the objects of automation is to reduce manufacturing costs, a typical manufacturer can readily find applications for automatic machine tools within his plant. However, the manufacturer should recognize that pitfalls await the unwary—there are various degrees and methods of automation which might be used to accomplish a given job.

This can be illustrated by considering specific parts, tracing the evolution of their manufacturing operations through various developments which eventually resulted in a high degree of automation. The keynote to progress is combining or integration.

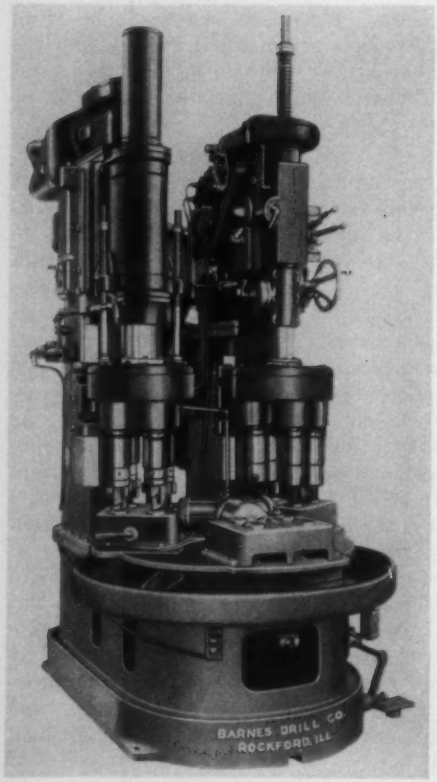


Fig. 2—Two-spindle production unit has hydraulically operated three-station index table. Air-operated fixture at each work station holds four nuts which are bored in first work station and tapped in the next. Operator loads and unloads parts in front station.

Automation is often characterized as "one machine performing many operations." The author shows how combinations of operations result in automation of drilling and related production operations.

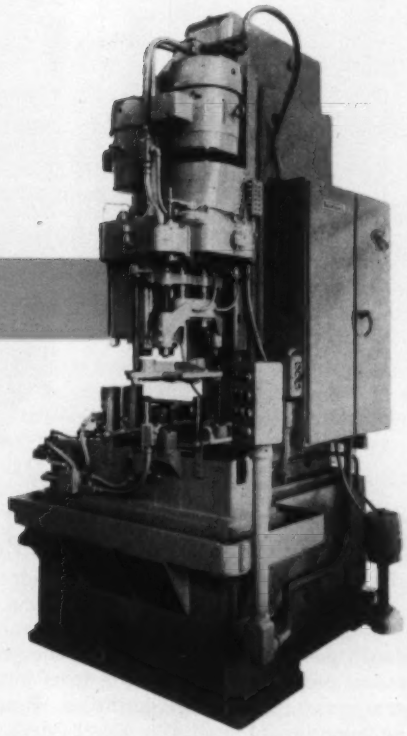


Fig. 3—Reaming and tapping machine has automatic loading, multispindle and multifixture features.

For the first example, which illustrates the first degree of combining, we have picked a simple nut as the part. This part must be bored and tapped. In the preautomation stage the manufacturer had two machines and two operators. His first step toward automation was to purchase a two-spindle gang type drill—one spindle being used for boring and the second used for tapping. This machine combined two machines and reduced direct labor cost while maintaining the same production.

The manufacturer's next step, the initial degree of automation, is to provide a multispindle drill press with an endless belt, and automatic unloading, *Fig.* 1. Another method may be provided by the rotary indexing table, *Fig.* 2. Both of these methods are accomplished by combining the tools in the multispindle head, fixtures (more parts per fixture) and a conveying mechanism.

Next degree of automation for this part is to combine automatic loading with the multispindle, multifixture machine, *Fig.* 3. This again reduces the direct labor cost by requiring only one operator to run several machines. The next degree of automation for the nut considered will be the combining of the machine in a conveyor line by use of automatic loading and unloading, requiring a minimum amount of direct labor.

Production of pillow blocks and covers may be used as another example. These parts require accurate drilling and in the past were worked on radial drills with individual fixtures. Pillow blocks are not manufactured in large lot sizes but are produced in large quantities.

Combination of tools and the addition of a conveying mechanism provided automation for one manufacturer of these parts. One machine is now used for all that company's designs of pillow blocks and covers. This machine consists of an adjustable multispindle head with a two position indexing table, *Fig.* 4. The adjustable head cuts tooling costs to a minimum by allowing drill spindles to be changed to different hole patterns without requiring different drill heads. Still another act

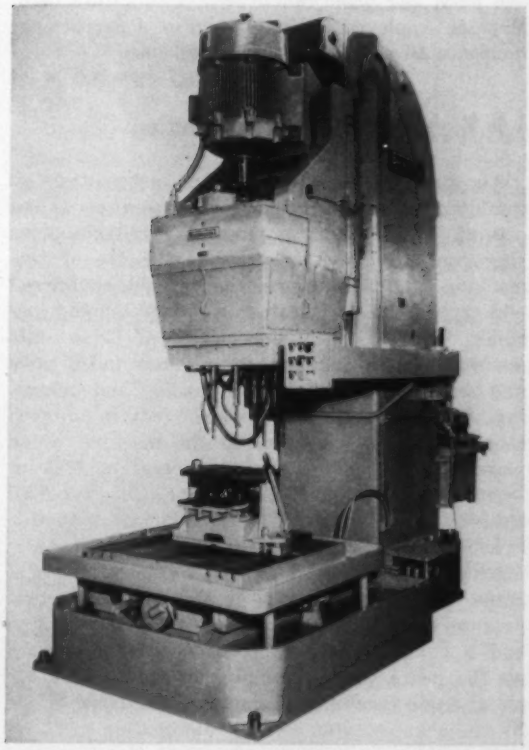


Fig. 4—Hydraulic feed, vertical way type drilling machine has multispindle head with adjustable location of spindles provided to facilitate setup of different hole patterns. Two position indexing table increases machine's utility. Adjustments permit drilling of a complete line of various sized pillow blocks and caps.

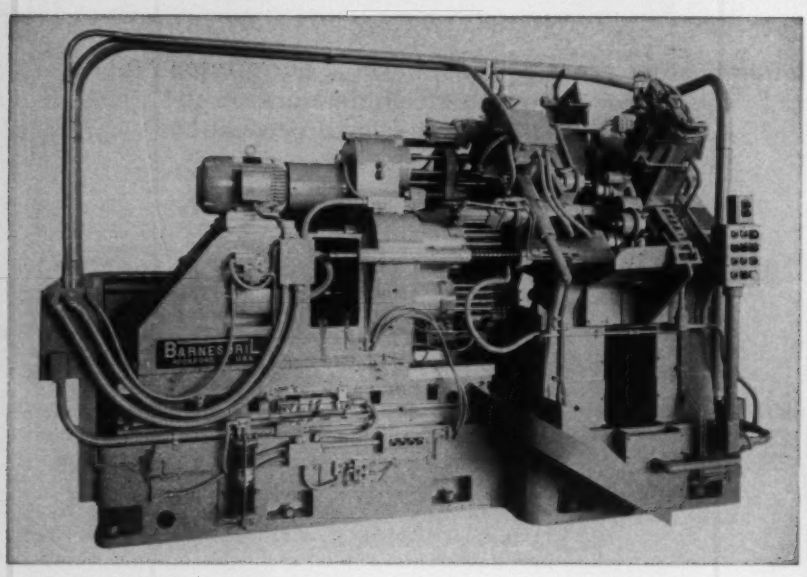


Fig. 5—Eight-station hydraulically operated drum operates in conjunction with 50-spindle head and automatic loading and unloading mechanism to drill, tap and gage rear axle drive ring gears.

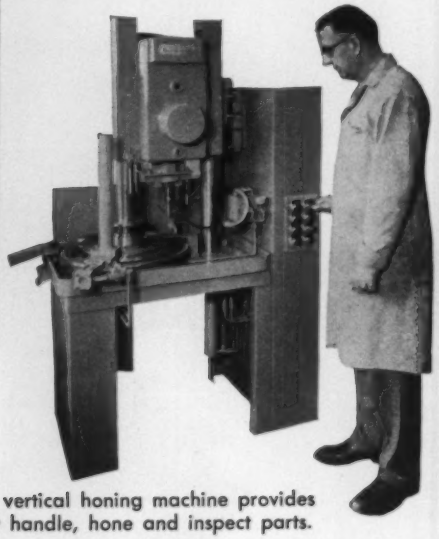


Fig. 6—Single-spindle vertical honing machine provides cycle to automatically handle, hone and inspect parts.

of combining is achieved by this machine. This is the combining of the old fixtures and the new machine. Another example of this point is the drilling of planetary gear carriers which were also previously drilled on a radial drill. Costs for manufacturing are again cut as all holes are drilled in one pass, and older radial drill fixtures are used. Machine employed is similar to *Fig.* 4 except that it uses a 16 spindle slip type drill head.

▶ Higher Degrees of Automation

An example of more complete automation by combining of all elements of an operation is the drilling, tapping and gaging of rear axle drive ring gears, *Fig.* 5. Previous to the use of this machine the manufacturer had reamed, chamfered and tapped the ring gear on a rotary tapping machine. The old machine consisted of three units mounted around a four-station rotary index table and required an operator for loading and unloading. The machine shown does not require an operator. Parts are conveyed to the machine which passes the part on for the next operation. The integration of this machine into the line required close co operation with the manufacturer. In this example a turning machine feeds the automatic machine which in turn feeds a finish turning machine. Previous machining is extremely important as more than one size ring gear is run on this line and a common location point must be used for all the gears. This combining of parts to be run on a single machine eliminates stock piling. Due to the completeness of the automation, probing and checking of previous operations were required and subsequently built into this machine.

Still another example of more complete automation is in hole finishing, *Fig.* 6. This small honing machine for gears is magazine fed. Operations include a pregaging station, automatic bore to bore sizing, post gaging and sorting. The pregaging stations prevent undersize parts from jamming the machine and thus causing downtime. Post gaging and sorting automatically select good parts which continue on, select oversize parts which are removed to the scrap basket, and select undersize parts which are removed and rerun. Excessive repeating of oversize or undersize parts will stop machine operations.

An example of more extensive combining of operations is the in-line transfer machine, *Fig.* 7. This transfer type machine not only performs metalworking operation such as drilling, boring, tapping and milling, but also automatically assembles timer pins and welsh plugs in cast iron timing chain covers. It should be noted that this combining of machining and assembly is done with no loss of production. Had the assembly work reduced the production level of the transfer it would not have been combined.

Depending on the configuration of the workpiece to be machined and the machining operations to be combined on one machine, the layout of the machine may take one of several basic types. Horizontal index tables of the type show in *Fig.* 2 are made in larger proportions to handle both sides of a part, as in the case of drilling automotive exhaust manifolds, *Fig.* 8. Where work must be performed on both sides of a part it is sometimes more convenient to use a horizontal axis of index and mount drill heads on each side of the fixture as in the case of a double end trunnion type machine for rear axle shafts, *Fig.* 9.

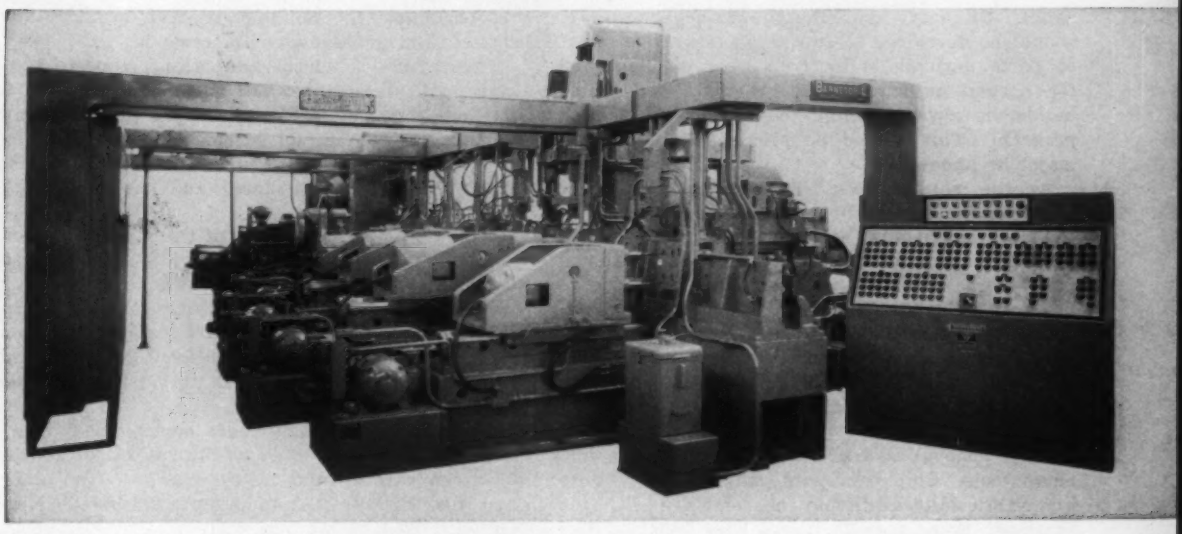


Fig. 7—This in-line transfer machine has 26 stations. In addition to drilling and tapping operations, machine also assembles timer pins and welsh plugs in timing chain covers.

Combining the working of a variety of parts and materials on one machine is still another example of automation, *Fig.* 10. By providing quick feed rate change through the use of a volume control valve on the hydraulic system, and speed changes through readily accessible pick off gears, this machine works commercial fuel pumps of aluminum and cast iron in alternate runs. To take care of bolt circle patterns, interchangeable cluster type multispindle heads are used.

High production rate is not always a prerequisite for automation. The aircraft industry has for some time required more automation. Their type of production (high volume, small-lot sizes of parts with similar characteristics) instigated the development of BarnesdriL Numerical Controlled Programming Machines, *Fig.* 11. These machines combine engineering data and machine capabilities plus fixturing. This type of machine greatly reduces setup time and tediousness of machining operations. Tooling cost is held to a minimum, because hole size or location change means only a revision in the tape instead of expensive fixture change or fixture replacement.

General Considerations

Various examples of combining for automation have been shown, now we would like to discuss points which should be considered when developing automatic machine tools.

Preventive maintenance is the most important point to consider for efficient automatic equipment. Production requirements per machine should never be so high as to limit preventive mainte-

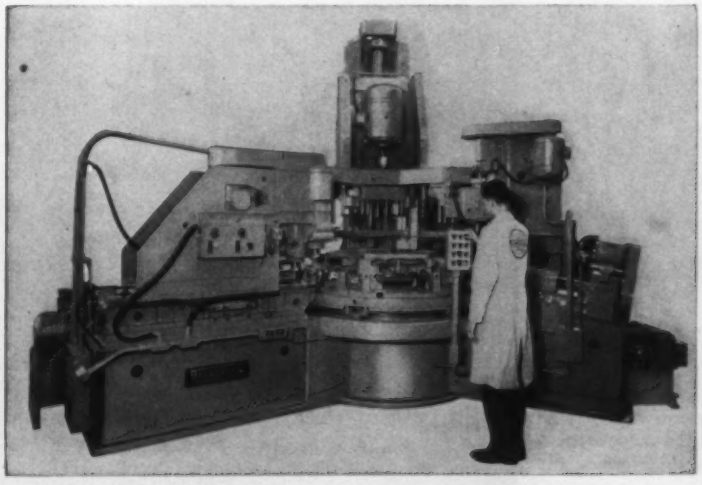
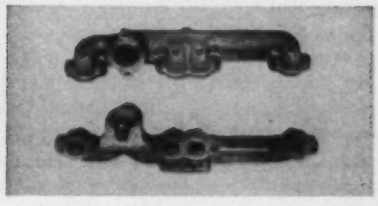


Fig. 8—Rotary index machine for drilling, milling, counterboring, reaming, and tapping operations on exhaust manifold castings. Each work station has two fixtures. Parts are loaded in two different positions to accomplish all operations combined into this one machine.



nance. On every automatic machine a program should be developed to shut down for replacement of parts normally subject to wear, tooling, and for normal adjustments for wear. The machine builder is always willing to help set up such a program. This should be provided for before a major breakdown.

Another point to consider is a common reference point on the part. All accuracy is lost in changing location points between operations. Rough parts are usually run on a qualifying machine prior to the automatic machine. Depending on the physical nature of the part, the qualifying machine may be included in the automatic machine or connected by an automatic conveying mechanism. Once a location point is machined it should be used for as many of the subsequent operations as is practical.

Chip removal is a necessity for automatic machine tools. Chip conveyors, magnetic separators and fabric filters all may be combined with the machine. Some manufacturers have assumed this responsibility by building central systems for coolant and subsequent chip removal.

Lubrication is another important point to consider with regard to automatic equipment. All moving parts must be lubricated automatically and provisions made for automatic warning devices to warn of bad conditions such as no lubricant, break in lubrication lines, and malfunctioning valves.

Automation or combining of the aforementioned points can best be accomplished by co-operation of the two interested parties. The manufacturer must clearly convey all pertinent information concerning his part to the machine builder. He then must rely on the machine builder to develop and present the most economical automation for the part.

Most machining features can be combined. However, combining of each additional feature must be given careful study with regard to the other features. Pitfalls of automation must be considered with each advantage.

Fig. 9—Eight-station double end trunnion type machine performs operations on both ends of rear axle shafts simultaneously.

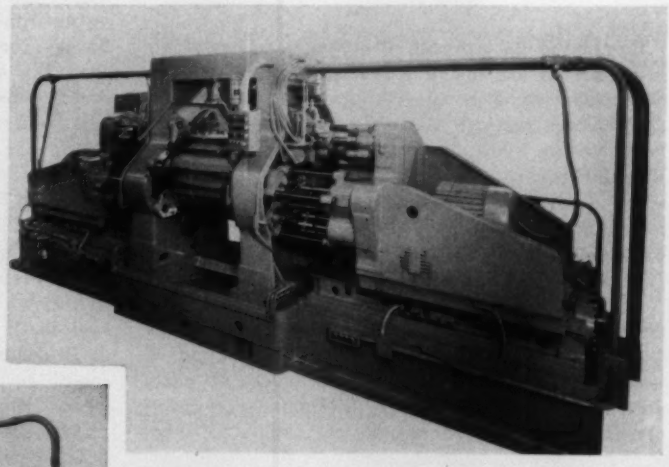


Fig. 10—Variable hydraulic feed rates and pick-off gear speed changes enable this 9-station drum type machine to perform combined operations on either aluminum or cast iron fuel pumps.

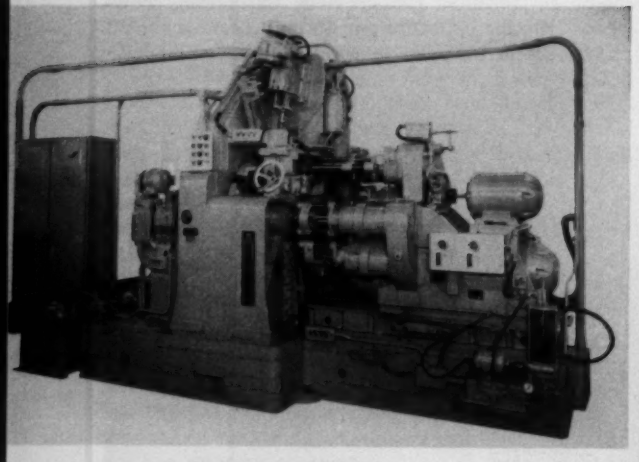


Fig. 11—Punched tape controls and programs vertical spindle movement and rotary table indexing to achieve automatic operation of this horizontal spindle drilling machine.

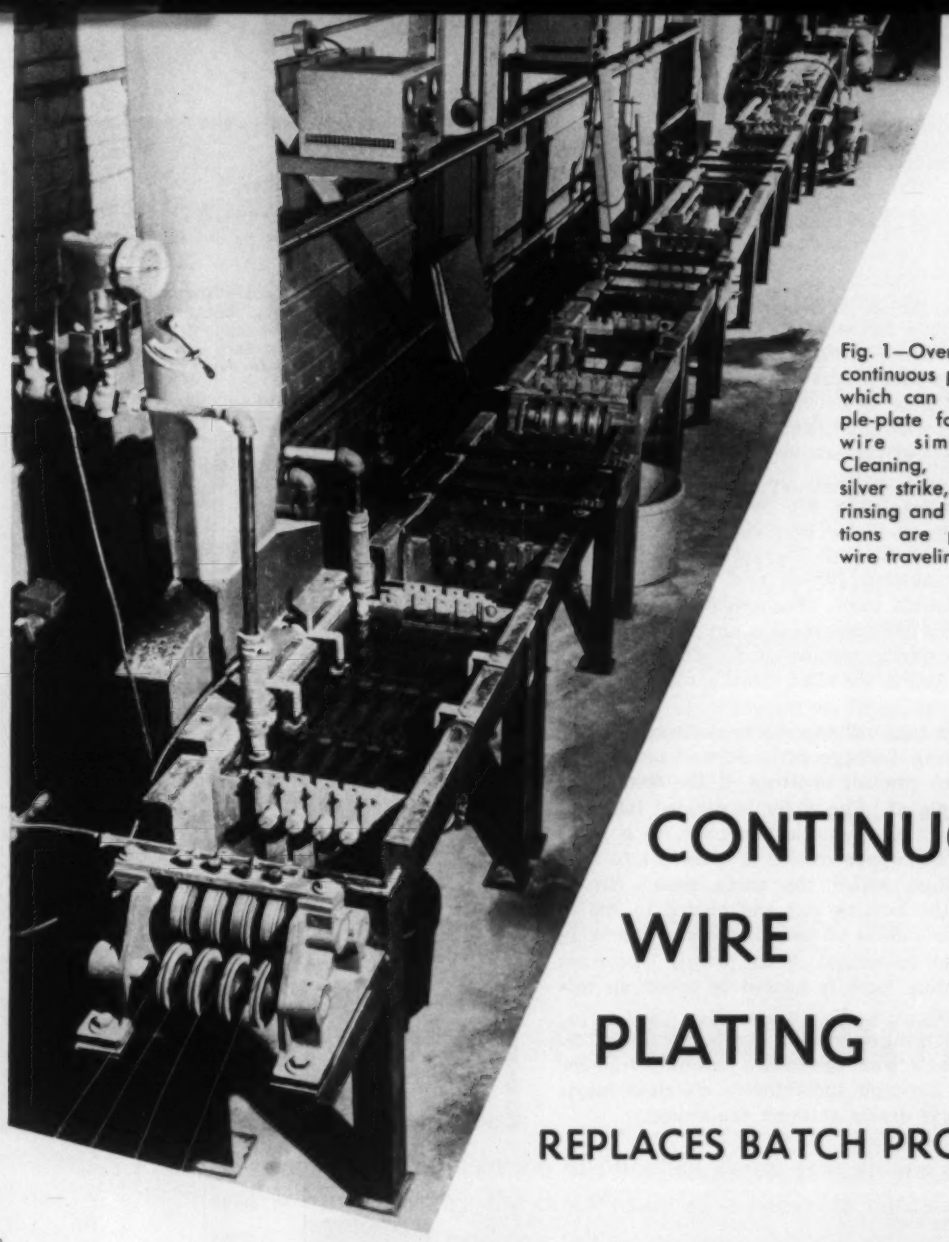


Fig. 1—Overall view shows continuous processing line which can clean and triple-plate four strands of wire simultaneously. Cleaning, nickel strike, silver strike, silver plating, rinsing and drying operations are performed on wire traveling at 5 fpm.

CONTINUOUS WIRE PLATING

REPLACES BATCH PROCESS

TO TRIPLE-PLATE four strands of wire at a time in a continuous process, Wilbur B. Driver Co. is using a wire plating system built by Hanson-Van Winkle-Munning Co. The continuous system, *Fig.* 1, simultaneously takes four strands of fine wire, usually manganese-nickel, through 12 cleaning, plating, rinsing and drying tanks and then rewinds them. The usual setup provides nickel strike, silver strike and main silver plating operations. Rated speed of the system is 5 fpm for each strand, giving a total rating for the installation of 20 fpm. At this speed a given point on a wire will travel through the system in about 10 minutes.

Formerly the plating job was performed by a batch method in which coils of wire were immersed in a succession of solutions. But that method provided little control over uniformity of plating thickness: Outside surfaces of a large immersed coil could receive an excessively heavy coating while inner surfaces received little or none. Where the plated wire is to be drawn to smaller size, as it is at this plant, uneven plating presents an especially critical problem in meeting of specifications.

The 12 processing steps in the continuous line and their duration at a wire speed of 5 fpm are noted in TABLE 1. By adjusting the 2-hp variable speed motor which pulls the strands through the system, wire speed can be varied between 2 and 14 fpm. Variations in plating thickness for different products can be obtained by adjusting plating current and speed of the wire.

Contacts for plating current are made with a strand of wire as it enters each electrolytic tank. Current is fed to each wire through a copper or

brass sheave which rotates, *Fig.* 2. Two idler sheaves maintain the wire in positive contact with the contact sheave. Every tank is provided with seals at all points where wire enters and leaves the tanks. These seals are mounted in sliding plates so that wire inlets and outlets can be raised above the level of the solution in the tank if wire is not being run through that line. Five rubber lined electrolytic tanks are used in the system. Power is supplied to the four electrolytic cleaning and strike tanks through 15-amp 12-volt selenium rectifiers. A 50-amp 10-volt unit is installed for the silver plating tank. The selenium units provide stepless power control for any required current changes during plating or for different processes. Each unit is installed directly over the tank it serves.

The twelfth tank in the system contains a newly designed drying arrangement. Forced air drying is provided to prevent spotting of the wire after it has been plated. The dryer is divided into two compartments; the lower section contains a heating coil and the upper section is divided into four tunnels through which the wires pass. Air is forced over the heating coil and heated to 200 to 250F. It then passes up into the tunnels, moving counter to the movement of the wires. The rinse in the preceding tank is heated to speed up this drying process.

After the drying operation the wire is rewound on spools. The rewind spools are powered from the drive motor through individually clutched heads and the wire is drawn through the system.

TABLE 1
Steps In Continuous Wire Plating
(Approximate times shown for wire speed of 5 fpm)

1.	Cleaning Tank	30 sec.—Caustic-silicate electrolytic bath; temperature is maintained at 180F; an exhaust duct draws fumes to an outside vent.
2.	Spray Rinse	30 sec.—spray rinse tank; unit can be converted to a soak rinse by closing the tank drain.
3.	Electro-pickle	30 sec.—sulfuric acid electro-pickle
4.	Spray Rinse	30 sec.
5.	Nickel Strike	45 sec.—thin coating of nickel plated on wire in a nickel chloride solution at room temperature.
6.	Spray Rinse	30 sec.
7.	Cyanide Dip	30 sec.—potassium cyanide solution at room temperature; exhaust draws fumes to outside vent.
8.	Silver Strike	45 sec.—thin coating of silver plated on wire in a silver cyanide solution to provide better adhesion for heavier silver coating.
9.	Silver Plating	2 min.—silver cyanide solution maintained at 100-110F; solution continuously filtered and pumped back into tank.
10.	Spray Rinse	30 sec.
11.	Soak Rinse	30 sec.—hot water bath maintained at 160-180F.
12.	Dry	30 sec.—hot air blast heated to 200-250F.

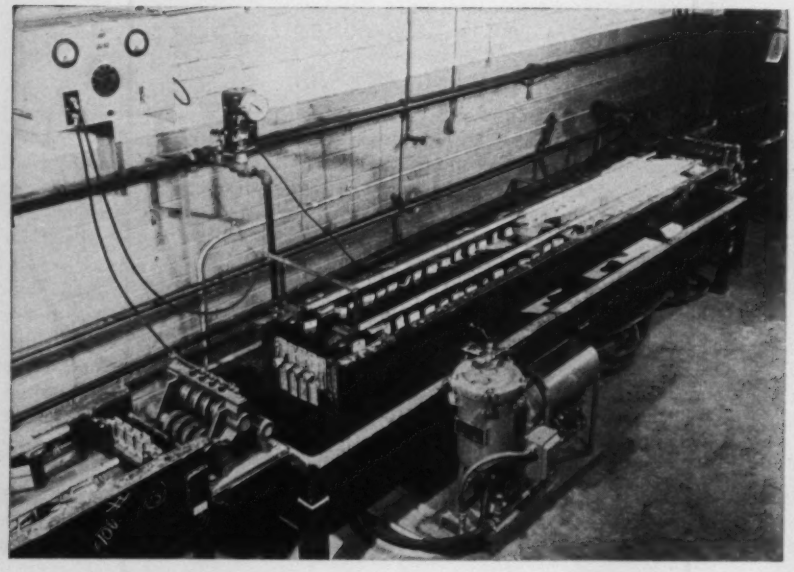


Fig. 2—Closeup of plating tank illustrates how contact with each wire for cleaning and plating currents is made by a rolling sheave. Plating anodes are hung along the path of wire through the tank.

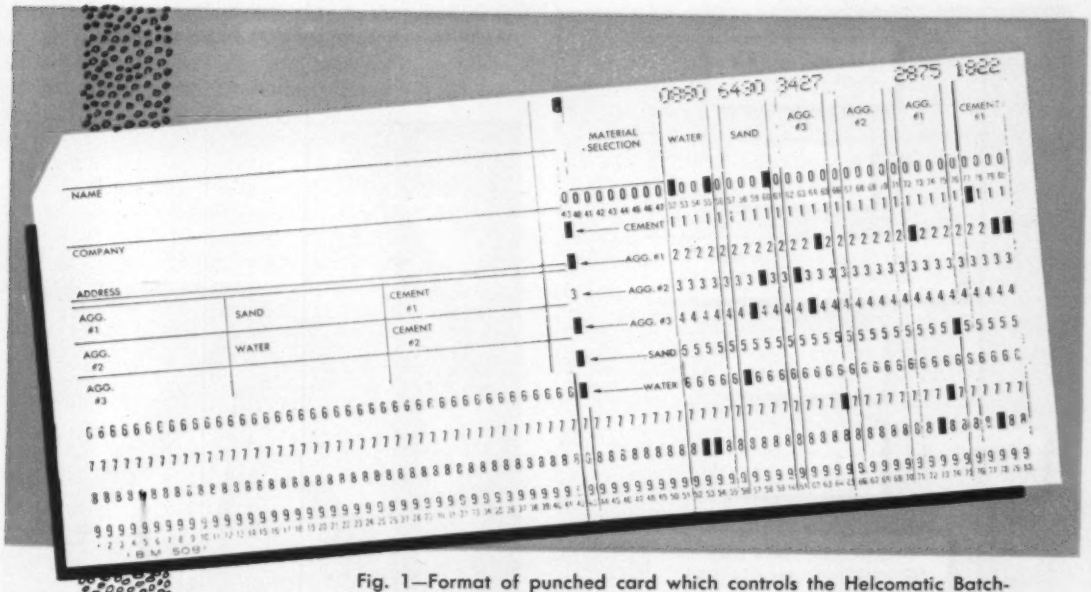


Fig. 1—Format of punched card which controls the Helcomatic Batchmaster. Decimal values of punches can be visually interpreted by operator. Unpunched portions of card can be punched for identification and accounting purposes.

CONCRETE BATCHER ACTUATED BY PUNCHED CARD CONTROL

The expanding application of punched cards as a means of control is illustrated by the description of a concrete batching system. Of general interest, the basic card reading device is not limited in use—possible applications include a variety of operations capable of electrical control.

By **ALEX SHERMAN**, Manager, Electronics Div., Peerless Electric Co., Warren, Ohio

IN DESIGNING a multipurpose electronic control unit actuated by punched cards, the Electronics Div. of the Peerless Electric Co. has anticipated the use of the unit in plants where integrated data processing is applied. The same IBM card which actuates the control unit to accomplish a desired production operation also can be used to record production and accounting data for subsequent processing by standard punched card data processing equipment. Companies without data processing installations benefit from the typical plus advantages of using controls actuated by punched cards: rapid manipulation of controls to meet varying requirements and elimination of operator error in control adjustments.

The control unit has been applied to an automatic ready-mix concrete batcher built by Heltzel Steel Form & Iron Co. Called the Helcomatic

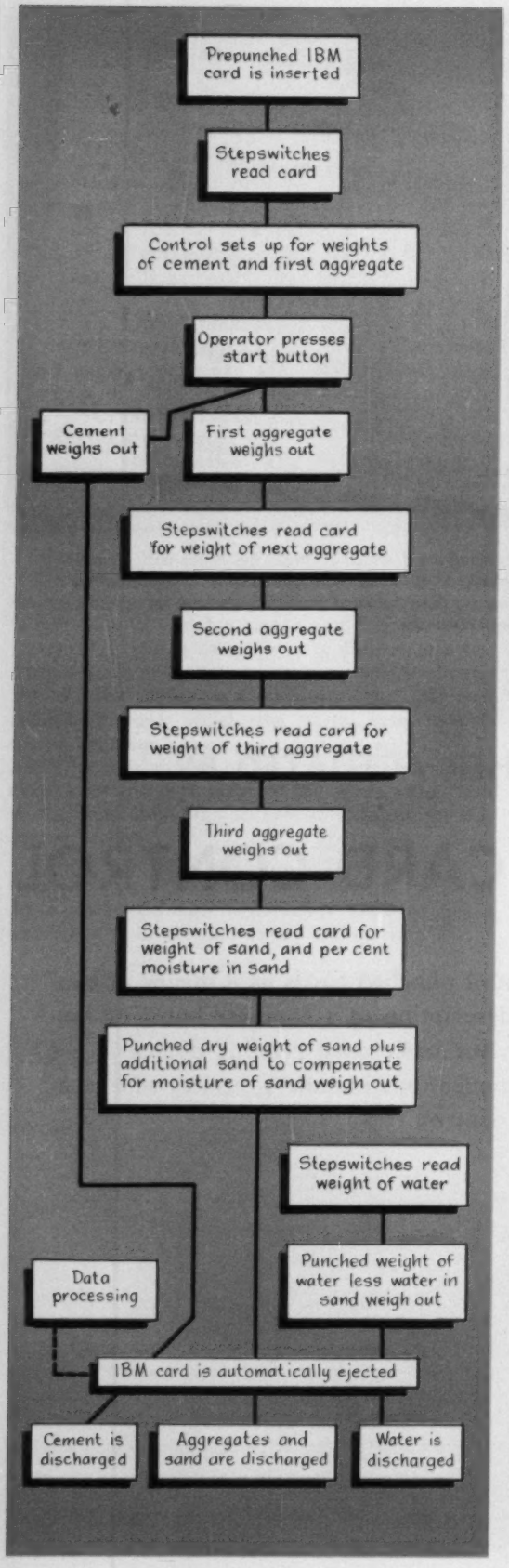

Prepunched IBM card is inserted
Stepswitches read card
Control sets up for weights of cement and first aggregate
Operator presses start button
Cement weighs out
First aggregate weighs out
Stepswitches read card for weight of next aggregate
Second aggregate weighs out
Stepswitches read card for weight of third aggregate
Third aggregate weighs out
Stepswitches read card for weight of sand, and per cent moisture in sand
Punched dry weight of sand plus additional sand to compensate for moisture of sand weigh out
Stepswitches read weight of water
Punched weight of water less water in sand weigh out
Data processing
IBM card is automatically ejected
Cement is discharged
Aggregates and sand are discharged
Water is discharged

Fig. 2—Sequence of actions controlled by punched card reader in automatic concrete batching system.

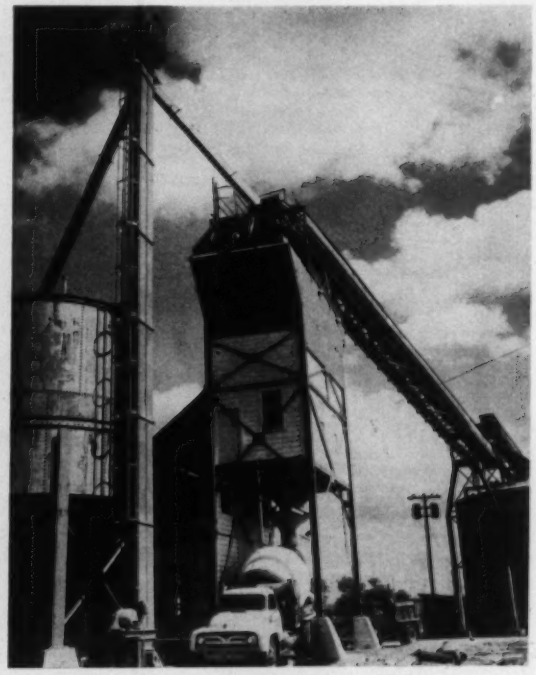


Fig. 3—Card controlled batching system is operating at Tulsa plant of McMichaels Concrete Co. Weigh batchers are located in rooms directly above hopper shown loading truck. Control point is in second story room with windows overlooking loading point.

Batchmaster, the system automatically controls the weighing of any combination of sand, aggregates, water and cement without manual supervision. Operation of the Batchmaster is simple. The dispatcher-operator merely inserts into the card reader a card punched for the desired formula. A push of the *Start* button results in an automatic sequencing and checking of all phases of the operation until the desired batch is completed within an accuracy of 0.10 per cent of full scale.

The card that operates the unit is a standard IBM punched card normally associated with data processing equipment. For convenience, part of the card is used for identification data—customer name, job number, etc.—and other administrative data. Remainder of the card contains information necessary to operate the batcher.

The card is divided into columns corresponding to material from which the selection is to be made. In the columns are lines of digits from zero to nine. Each line is punched decimally for the specified weight of the corresponding material. The single vertical column which lists the available materials permits selection of any combination desired.

Use of a decimal system makes the card easy to punch and easy to read. Normally, each card is used for only one batch and then coded or noted for billing purposes. However, the same card can be used repeatedly and it can serve as a permanent record of batch specifications.

In the Helcomatic unit, data from the card is relayed through control circuits that operate various components such as motors, solenoid operated valves, vibrators, aerators, etc. which dispense the desired weight of materials. The unit permits weighing materials on several scales or cumulative on one scale. A differential transformer, linked mechanically to the dial scale, presents a control output voltage which establishes the various cut-off points during different phases of the weighing operations. In cumulative weighing, the unit automatically subtracts from the scale reading the weight of material previously dropped into the hopper.

▸ Special Features

As has been mentioned, the card is punched with the individual weight of each material in a desired formula. One of the simplifying features of the control unit is the retention of the punched card in the reader during the delivery of all materials for one batch since this eliminates the necessity for extensive memory circuits. Another feature to be noted is the ability to obtain repetitive and continuous accuracy without requiring regular scale balancing. The voltage output of the differential transformer which is used to control the bin gates through relays results in an electrical equivalent of each weight that is repeatedly the same value. A recycling feature permits leaving the same card in the reader for any number of repeating batches and the unit can count the batches and stop operation after a preset number of batches.

Included in the permissible operating adjustments which can be made is a provision to change the operations from automatic to manual when required. For manual operations, the operator reads the weight from the dial scale. For both automatic and manual batching, the machine delivers the last few pounds of critical material by slow feed. The rate of slow feed is adjustable.

For increased accuracy, a "material-in-air" adjustment on the unit compensates for the weight of material suspended between the charging gate and the weigh hopper at the instant the scale transmits the gate closing signal. The operator makes this adjustment with a dial on the control panel. In effect, the machine automatically closes the bin gates early so that the material in the hopper plus the column in air equals the specified weight.

The unit is also provided with a sand-moisture adjustment to assure a uniform proportion of water in each batch despite the moisture content of the sand used. The operator periodically de-

Fig. 4—View of control room. Card is inserted into reader in manner shown. Recorders in background continually chart weights of materials batched. Components in relay cabinet are mounted on sliding shelves or hinged panels for easy access.

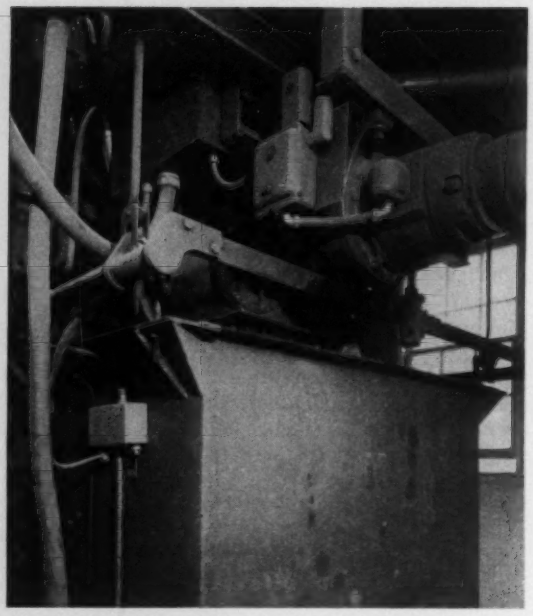


Fig. 5—Example of weigh batchers used in automatic system. This cement batcher is provided with motor driven vane feeder which automatically provides slow feeding of last few pounds of cement required by formula to assure accuracy of weight.

termines the sand moisture content and sets a per cent moisture dial on the control board. The dial is graduated in 0.5 per cent steps up to a maximum of 10 per cent. Enough extra sand is automatically delivered to the hopper to compensate for the weight of water in the quantity of sand used and that weight of water is also subtracted from the amount of water specified by the punched card.

▶ Variety of Uses

Essentially, the control unit transforms the digital information on the punched card into an analog output. The controlling media is thus a voltage that can be used with the many existing control and drive components commonly found in powered equipment. In short, the basic control unit can regulate any operation or process that can be controlled by the use of numbers.

As the illustrated application controls the weight in a batching process, similar card reading equipment could control other quantitative units such as length, width, depth, pressure, voltage, temperature, volume, and other units of quality control. For instance it would be possible to apply the control unit to accurate short-run tests of electric motors for torque, maximum current and ground test voltage. The numerical values for the desired test would be punched into the cards; the unit would then control the testing for the desired values.

A very flexible design results from the type of circuits employed in the card reader. In addition to reading punched information, it is possible to have the units record information as the result of a sensing operation. Accuracy in any application is limited only by the sensitivity and accuracy of available sensory elements and transducers. Application is limited only by the presently available means of performing work electrically.

TESTING COMPLEX ELECTRONIC SYSTEMS

CERTAIN DEVELOPMENTS in weapon electronics are of interest to industry in general because of a common problem created by the use of complex electronic equipment—that problem is maintenance. Replacement of manual techniques with automatic instrumentation is mandatory to reduce the time element to practical limits.

The Sperry Gyroscope Co., Div. of Sperry Rand Corp., has sponsored a system engineering investigation that has resulted in a concept identified as Rapid Automatic Checkout Equipment (RACE). The investigation covered the problem of automatic checkout and the development of basic techniques and equipment.

A typical setup for testing a missile system consists of a programer and sub-programer, switching networks, programed signal generators, output transducers, comparators and fault indicators. The equipment specifies the tests to be made, determines their sequence and sends appropriate test signals to the system being checked. The system responses to these signals are compared with stored data and the results are displayed to an operator on a "go no-go" basis.

There is one important procedure that cannot be ignored if successful results are to be obtained in developing testing equipment for a complex electronic system. It is essential that a testing study program be undertaken concurrently with the study of the system itself. The system must be designed with test points which will permit quick connection of the test equipment to the system.

Recommendations for test procedure, analysis of test time, test points, built-in features and packaging recommendations should be made before the actual hardware design of either the weapon system or the support equipment is actually begun. An improvement in testing efficiency will come about if proper correlation is made at the time the system is designed.

Employment of the RACE concept would be of definite advantage in the field of manufacturing automation. Shorter scheduling time, coupled with a large volume of units to be handled, may easily require automatic, self-checking equipment on the production line.

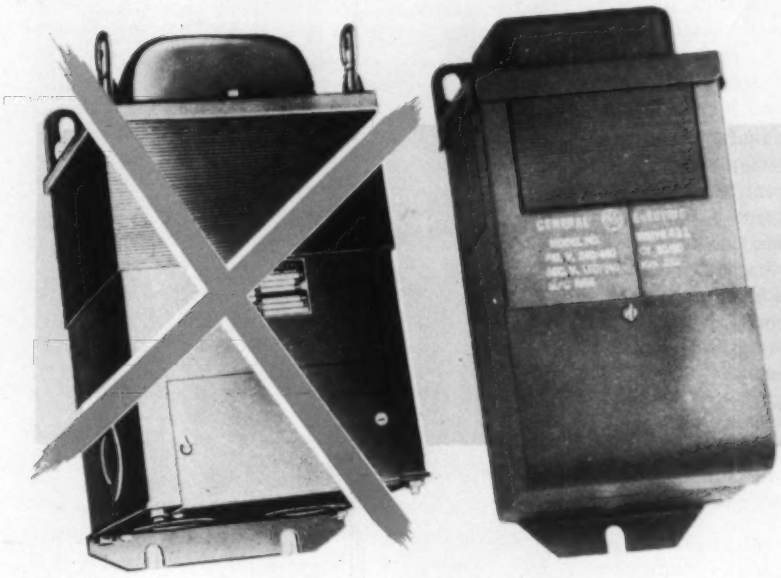


Fig. 1—Old type of control transformer construction in 0.250 kva to 2.0 kva sizes. New design was indicated because of the difficulty in automating the manufacture of this design

CONTROL TRANSFORMERS

DESIGNED FOR AUTOMATIC PRODUCTION

This article clearly demonstrates the influence of automation on product design, shows that automation is a prime consideration in product design economics and will have a fundamental effect on all future product design decisions.

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CONTROL TRANSFORMERS differ from other dry-type transformers principally in power output and voltage rating. Arbitrarily, control transformers have been classified as those supplying blocks of power from 0 to 3 kva, at any output voltage from 0 to 600 volts. Customers for control transformers are small users and electrical contractors who buy from franchised distributors, or original equipment manufacturers who buy direct from the factory. Whereas general purpose transformers (3 kva and up) are used principally for lighting and power applications, control transformers have a multitude of uses in today's electrical and electronic world—machine tool control, relay and contactor pickup, filament lighting, low-voltage gas or oil ignition, remote control, chime or bell operation, voltage step-down, and many others.

Probably the most common use of control transformers is in transformation of secondary distribution voltages of 600 volts or less to lower power circuit voltages required for lighting and control panels. Such transformers have standard voltage ratings such as 600/120, and 480/240, and the like. To meet the needs of increasing numbers of elec-

trical and electronic equipment manufacturers however, control transformers delivering output voltages of practically any value from 0 to 600 volts are required, with primary or input voltages also varying from standard distribution line voltages of 120, 240, 480 and 600 volts. Transformers of this nature perform such functions as relay and contactor pick-up, filament lighting, power rectification, buck-boost, and low voltage gas or oil ignition through the use of heating elements.

Control transformers in the specialty transformer department of General Electric represent an important part of the available control transformer market which exceeded $15 million in 1956. Control transformer production is expected to more than double by 1961.

Recognition of the Need

Early in 1954, a project which involved the redesign and establishment of a new, mechanized standard control transformer line was undertaken by G.E.'s Specialty Transformer Dept. Events leading to the decision to design and produce a new control transformer came about slowly over a number of years. The department had a line of control transformers and a pricing structure which had been in existence for a number of years. With the passage of time, labor and material costs had increased.

Sales were chiefly to original equipment manufacturers (OEM) and distributors. Several years ago, the Specialty Transformer sales section went into a franchised distributor program for large general purpose transformers. This soon appeared to be a good market for control transformers too. However, the existing line of control transformers involved only single line and output voltage ratings, and was not conducive to distributor sales since too many different transformers were required for stock.

As progress was made in the new franchised distributor program, the sales section realized more and more the need for a new control transformer line with dual voltages and dual frequency. It was decided that not only was a new transformer design required, but also, a new marketing pattern for control transformers—with more emphasis on the distributor market.

This basic need for redesign of control transformers to dual voltages and frequency led to seeking of other design advantages. We in the engineering section began by asking a few pertinent questions:

1. Should the redesign to dual voltages and frequency be made on existing standard parts, or should a completely new mechanized design be devised?

2. Should the basic design parameters involving present insulation systems be utilized in the redesign, or should attempts be made to change to a completely new line of control transformers involving a new insulation system?

3. Was the emphasis on redesign to be placed on material reduction, labor reduction, or some happy compromise? Was the new line to consider latest techniques for automation with attendent high investment?

4. What production figures should be used—forecasts for five years ahead or for ten years ahead?

5. As long as a completely new line of transformer ratings was to be introduced, were there any other important factors that should be considered in the electrical redesign besides the dual voltage and frequency?

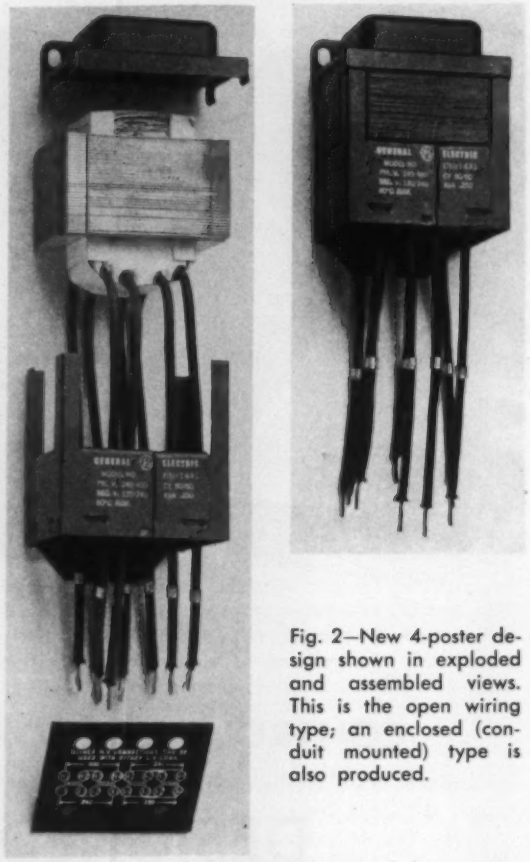


Fig. 2—New 4-poster design shown in exploded and assembled views. This is the open wiring type; an enclosed (conduit mounted) type is also produced.

Obtaining answers to these and other questions involved many meetings among all functions of the Specialty Transformer Department. Answers had to be found, so that the basic designer could proceed with a plan and objective firmly in mind.

When the answers to some of the questions had been obtained, a definite plan of action commenced to be formulated. Emphasis was to be placed on standardization of parts, along with overall cost reduction. The possibilities of our incorporating a new insulation system into this new control transformer line should be thoroughly investigated. Mechanical design should be simplified so that automation could be feasibly and economically applied

in the manufacture of the transformers. The new control line should be designed, tooled, and planned to produce at forecasted 1961 production levels. Existing quality of the product was to be maintained, if not improved. The new control design should be weather-proof, corrosion resistant, and capable of withstanding vibration specifications, impact, and shock. There should be no increase in noise level over existing designs.

From our marketing research team came a forecast through 1961. This included a detailed breakdown of volume by ratings. Several definite approaches toward the design of a new line could be taken. Each approach could be studied and accepted or dropped. The areas to be covered in the development were:

1. Insulation system.
2. Core lamination and enclosure design.
3. Standard sizes.
4. Treatment and finishing methods.
5. Identification method.
6. Test and inspection methods.

Investigation of each of these areas required close co-ordination of all functions by the design engineer—drafting, planning, cost, manufacturing, marketing and quality control. Meetings were initiated by the engineer, bringing together those parties which had a definite interest whenever any specific final decision was being made. Thus, decisions were generally compromises achieving the optimum design for all factors considered.

▶ Design and Development

Materials utilized in control transformers are conductor material, magnetic core material, insulation material, and enclosure material. The design engineer has the problem of how best to combine the required materials into an optimum design system. Several good choices are available to him in each category. His decision as to which system will be used is in part based upon his being convinced that the selected system will give long life at the particular ultimate temperature at which it will operate. To prove this, he must make suitable accelerated life tests.

Of even greater importance, the design engineer must show conclusively that the selected design system will give quality performance at the lowest overall cost. In order for him to do this, he must make many design layouts and must run elaborate cost studies on materials and combinations of materials.

Insulation material is required in a transformer to isolate the transformer windings from each other and from the core and enclosure which is generally at ground potential. Also, insulation is required on each strand of conductor material in a coil to prevent the short circuit of turns within a winding. Existing control transformers utilized a Class A insulation system which may be used only where the operating temperature never exceeds 105C, see TABLE I. The insulation system included organic material such as paper, phenolics, acetates, etc., all of which deteriorate rapidly above 105C. As a consequence, when designing a Class A unit, copper and iron losses must be limited to levels which will not cause temperatures to exceed 105C within the coil.

About three years before the start of the control transformer redesign project, larger general purpose transformers were redesigned to a new Class B insulation system which permitted coil winding temperatures of 130C with long life. This Class B system consisted of materials such as glass, asbestos, mica and other inorganic materials. The advantages of a class B system over a Class A system is that smaller units may be designed using less materials, since due to the higher operating temperature allowed, more transformer losses may be tolerated. The disadvantages of Class B are: higher inherent regulation, higher surface temperatures, higher unit cost of materials, and greater difficulty in processing inorganic materials. Could the Class B system be incorporated into control transformers to advantage? The answer seemed to be a loud and clear, "Yes" modified by two important, "If's":

1. If a suitable conductor insulation for round conductors had been developed and was available.
2. If a suitable thin-sheet layer and wrapper insulation had been developed so that coils could still be wound automatically.

As more and more advances are made in engineering knowledge of Class B materials, the more an engineer can justify their use. This was the case with the new control transformer line. The advent of Alkanex Insulating Material a high operating temperature Class B insulation developed by the General Electric Co., appeared to solve Item 1; Alkanex would replace Formex Wire, a Class A material also developed by G.E. A search of the latest inorganic materials on the market brought to light several possibilities for thin-sheet layer and wrapper insulations. Two of the most promising were treated asbestos and synthetic sheet material. Tests on both of these looked good. But, would the complete insulation system of Alkanex and some other material be compatible such that long life was assured at operating temperatures of 130C? There was only one way to answer this question—life tests. Several representative sizes of units were designed and samples built, treated, and put on accelerated life tests.

While units of the new insulation system were on life tests, trial designs on several sizes of transformers were made on both Class A and Class B insulation systems. The question which had to be answered quickly was whether the reduction in size due to Class B operating temperatures and higher cost inorganic materials would actually reduce the cost of a transformer designed to Class A temperatures in the control kva range? Would the processing of inorganic material in small sizes be prohibitive? Detailed design layout and cost studies of Class A vs. Class B designs revealed the following:

1. Class B designs would reduce size about 20-30 per cent over Class A designs.

2. In spite of higher cost core material and insulation materials, Class B designs showed some cost decrease.

3. The smaller size of Class B design would permit greater automation, thus lowering direct labor costs.

These were the initial answers. Soon thereafter, as accelerated life test results were obtained, the answer to the important question of transformer life jelled. It appeared that the new insulation system on trial would definitely give extremely long life at temperatures below 130C. By late 1954 it was decided that the new control line would be a Class B, 130C transformer line. Designs of all standard dual-voltage, dual-frequency ratings were begun. TABLE 2 indicates the reductions actually obtained in volume and weight on several typical ratings in the Class B line.

▶ Core Lamination and Enclosure Design

Typical conduit wiring construction of the old model control transformer, from ratings of 0.250 through 2 kva is shown in *Fig.* 1. This design had many advantages over competitive makes and had proved itself as a high quality design over a period of years. However, with a view toward automation, there were obviously many disadvantages. There were too many parts. Besides the basic core and coil a total of 24 separate parts had to be handled in the complete assembly of a unit. This would present formidable fixture problems in any mechanized line to take care of all the variables. Use of core bolts through core laminations presented problems of off-center holes, and difficulty in feeding of core bolts through holes. There would be high setup charges since each variation in design required several new parts. Mechanizing this construction would involve extremely high investment expense.

From the electrical design standpoint this construction posed other serious problems. Core bolts through laminations caused circulating currents at high densities resulting in high transformer losses. With the use of high silicon grain-oriented core materials, and high core densities on the new Class B design, this problem would be all the more difficult. Shifting of laminations within the core bolt hole clearances was always a possible hazard to the transformer coil. Pressure on the core stack of laminations by the end cap and sleeve was highly variable due to the use of core bolts and nuts. The amount of pressure supplied to the core was dependent on how much a particular operator decided to tighten the core bolts. Since undue pressure resulted in higher losses in the core material, designs had to be made conservative in order to avoid a high rate of rejects. This resulted in larger transformers with more material costs.

There was no question in the minds of all those concerned that the existing design could not be feasibly mechanized, nor was it an optimum construction for the New Class B control line. The search for ideas was on.

TABLE 1

Class of Insulation Material	Temperature (degrees centigrade) Limiting Value "Hottest Spot"
O	90
A	105
B	130
H	180
C	No Limit

There was also the question of a new enclosure. Primarily we needed a new type that would meet these requirements:

1. Parts should be so designed that they could be made on a progressive die at a high rate of speed.

2. The enclosure should house the transformer core and coil, and cable leads in a quick, automatic or semi-automatic assembly procedure.

3. It should be light, sturdy, and impervious to weather.

4. The basic design should allow for different sizes of lamination stacks and coils, varying in weight from 2 to 40 lbs., but still maintaining a uniform "line" appearance.

One of the initial ideas concerned the design of a drawn-case construction similar to existing ballast transformers. The drawn case would have one compartment for housing the core and coil transformer and an isolated compartment for housing the transformer leads. For purposes of improving heat dissipation from the core and coil to the surface of the case, it would be necessary to fill the transformer compartment with a suitable compound. (In "exposed core" constructions much of the heat is dissipated directly into the surrounding air from the core surfaces.) A separate cover could be utilized to cover the transformer compartment, and a removable cover for the wiring compartment. But this idea was soon dropped for several reasons. With no exposed core, heat dissipation was worse, and longer and bulkier units would be required. Compound filling was undesirable from the manufacturing standpoint, and inexpensive Class B compounds were nonexistent. The design still had too many parts and would require high tooling costs for the various sizes to be required.

A second idea involved the use of separate outside straps at core lamination covers arc-welded to the sleeve and end cap. This idea eliminated the problems of bolt holes, reduced the number of parts somewhat, but still lacked many desirable features.

A third idea involved the use of slotted open-end corners on the laminations, and retaining rods instead of holes and threaded bolts. Securing the core laminations in place was to be accomplished by the mechanical clinching of the sleeve around

the four retaining rods. This eliminated the need for the nut and also for the round holes in the laminations. It also made possible a faster assembly procedure.

However, this idea had certain serious disadvantages. The open corner slots were not considered weather resistant, and seemed to lower the quality of the transformer. There still remained the possibility of circulating current through core bolts though to a lesser degree. Different diameter and length retaining rods would be required from one model to another. Automation demanded that still fewer parts be required for low investment expense.

A fourth idea involved a 4-poster sleeve and cap construction with the core and coil being assembled into a single sleeve and the end cap attached to the sleeve automatically by tabs. This was called the 4-poster tab design, and met with almost immediate approval by most people concerned. The number of parts required was reduced to five. It appeared to be easily mechanized and, with proper design of core lamination would eliminate circulating currents at core corners.

Late in the summer of 1954 a general meeting of heads of planning, sales, cost, product planning, production, drafting and engineering was called to discuss the specific development to date, and to direct efforts for further development. Samples of proposed constructions and existing constructions including the clinch-bolt and 4-poster designs were available for scrutiny.

This meeting and further studies resulted in the decision that the 4-poster design presented the most advantages. However, one further idea was proposed. Why not projection weld the end cap to the 4-poster sleeve rather than use a tab in each of the 4 posts to contain the end cap mechanically? This suggestion was adopted, and a complete study of the relative merits of the two designs was made to determine, first, the better design from the automatic assembly standpoint, and secondly, the relative costs of equipment. Although assembly costs were approximately the same, welded design equipment was slightly less expensive than that for tab design.

In addition to the equipment savings there appeared to be several intangible advantages of welding over tab crimping. Tabs required more careful handling to prevent them from being bent out of line. Quality of steel must be consistently good with tabs to avoid breakage. Die maintenance increases with the tabs since slot punches must be kept in good order. Tabs increase setups on the sleeve die since different sleeve parts would be required for each variation in stack height. The tab design was inherently a mechanically weaker structure and general appearance of the tab design was worse than the welded design.

The full speed ahead signal for the new 4-poster case design with projection welding was (in Naval parlance) "two-blocked and executed". A special projection welder was designed which completely welds the parts automatically. We were on our way!

This 4-poster case construction shown in *Fig.* 2 had many distinct advantages over the existing control construction.

1. The number of parts handled was reduced from 25 to 5; these being the core with slotted corners, end case, sleeve, cover, and screw.
2. With slight additional tooling two basic constructions, open-wiring, and conduit mounted were provided, with minor changes in assembly and handling.
3. It was possible to automatically stack the core laminations into the 4-poster sleeve, thus simplifying assembly.
4. Core bolts were eliminated.
5. The cap could be automatically welded to the sleeve, with uniform pressure on all surfaces of the core. This results in more consistent test data with lower manufacturing losses and rejects.
6. The core was rigidly positioned within the sleeve posts resulting in an extremely rugged construction. Enclosure metal thickness could be reduced.
7. Appearance was improved appreciably.
8. Salvage of units, when required, was simpler since with removal of caps, entire core and coil easily falls out of the sleeve.

Now that the problems of the insulation system and of the enclosure design were licked, we devoted our attention to sizes. Since there are usually relatively few standard control transformer voltage ratings, sizes, weights, or methods of mounting, customers have very little information readily available to guide them in making a new layout which requires control transformers. More often than not a customer is forced to the conclusion that his requirements call for nonstandard equipment. Costly delays ensue as he requests quotations, size, weight and mounting information on his "special" transformer requirements.

However, most specials are simply a change in voltage rating from existing industry standards such as 6, 12, 24, 120, 240, 480, 600 volts. However,

TABLE 2

	Class A (Old Designs)		Class B (New Designs)	
KVA Rating	Volume (cu in)	Weight (lb)	Volume (cu in)	Weight (lb)
0.100	50	5.75	40	3.75
0.250	185	12.0	102	8.0
1.00	462	40.0	250	25.0
2.00	560	61.0	352	42.0

a change in voltage rating, within limits, does not mean a change in physical size, so long as the power output is the same. Thus, it appeared possible to establish fixed transformer constructions, related directly to power output steps, and have these sizes cover any design voltage rating within certain imposed limits. If this were possible, a transformer user need know only his power requirements to determine immediately the size of the special voltage transformer he desires. Handbook literature could refer to certain constructions as frame-sizes related directly to power output.

Two basic constructions are offered in the new 4-poster control line of transformers. These are, the open-wiring construction, with insulated leads out of the transformer for external wiring, and, the wiring compartment construction for conduit wiring. A particular transformer rating would utilize the same basic transformer core and coil regardless of the construction desired. Different constructional features, such as open-wiring, or wiring compartment, are handled simply by the addition of a suitable suffix letter to the basic frame size number.

Treatment and Finishing Methods

A thorough insulating varnish treatment of a transformer core and coil is mandatory not only for the protection of the insulating material against moisture, but also to improve the heat transfer characteristics, thus lowering the internal coil temperature to safe limits.

Existing methods of treatment were highly satisfactory insofar as quality of treatment was concerned. However, the method used was a batch-type treatment which involved fixing a large quantity of units on large racks, and treating the transformers (and the racks at the same time) in large treatment tanks. Prior to treatment, the units require a preheat bake for several hours in large ovens. Following the treatment, another bake is required to cure the treating varnish on the transformers.

The batch-type treating system did not appear to be the answer for a highly-mechanized line. One of the first ideas worked out and developed involved a new automatic monorail cycling vacuum impregnating process, replacing the batch-type treatment. This process, except for loading and unloading, practically eliminated labor in handling. Either individual transformers or groups of transformers could be loaded on an overhead monorail conveyor handling system. The overhead monorail conveyor carries the transformers through preheat ovens, automatic impregnations, bake-cure ovens, through the finishing area, and through the final cooling chambers.

To achieve desired finish in production it soon appeared that an air spray finish would have to be developed that was economical. In further consideration of techniques, it appeared that automatic air spray of paint finish would be both possible and economical. The procurement of an air dry paint also eliminated the necessity for final bake ovens.

After a complete analysis and evaluation of equipment and labor costs of an automatic paint treat system versus a batch type system, a compromise approach of a semi-automatic system was planned.

Indentification and Test Methods

Existing methods of identification of control transformers included the use of attached metal nameplates for larger units, and metal stamping on enclosures for smaller units. Neither of these methods appeared to be suitable for the new control line, principally because of the labor required for either process. An investigation of the cost of adhesive labels, paper and "metal-cals" proved uneconomical from the material and initial cost of dies standpoints. Another method was proposed involving rubber-stamping of nameplate information on transformer enclosures. This process was not new, but had never been carried out to any large extent except on hermetically-sealed electronic transformers.

Trials with the weatherproof marking ink, as used on electronic transformers, were made with sample control transformers and proved highly successful. The cost of rubber stamps to perform this operation was nominal. The use of white ink presented a highly desirable contrast against the blue-gray paint on the transformer. Use of rubber stamping eliminated both nameplate and nameplate screws, reducing further the number of parts needed to be handled through manufacture. This method of identification could be easily and quickly applied. The decision was unanimous, to go to rubber stamp identification.

Test time on existing control transformers was generally in the neighborhood of three to six minutes. Unless this was drastically reduced, the testing of transformers would become the bottleneck in the new control transformer line being geared to produce at the forecasted level. What could be done to reduce this time without reducing the quality of test?

One very obvious way to reduce test time was to reduce the number of tests required; another, to reduce the length of time for high-potential production testing. A third way was sample testing. A fourth way was improvement of test facilities.

One suggestion was to install surge testing as a new test, eliminating high potential and induced potential tests which took much longer times. Test specialists were sent out to see existing surge test facilities in other G.E. plants. They reported excellent results were achieved improving quality of units through surge testing. However, due to the nature of control transformers, having as many as four or more windings, it was impossible to economically supplant both hi-pot and induced potential tests by a single surge test.

It was decided that sample testing would be applied in the new control line, principally in the preliminary testing of transformer coils, *Fig.* 3, and untreated transformers. Unless the quality of units coming off the new line was proved to be extremely high, such that rejections were low, sample testing could not be considered for the final test of transformers at that time.

Improvement of existing test facilities appeared to be necessary and desirable for the new control line. Universal test sets then in use required too many manual operations, and too much depended on meter readings by the operators.

The time element was too short to hope to develop a completely automatic test setup before the new control line went into production. It was decided that some initial temporary improvements to existing testing methods would be made immediately, with the automatic test set to follow later.

Improvements added to existing test sets included a newly-designed terminal board that facilitated easy connection of transformer leads, a new system for checking continuity in the automatically-wound coils as the units are hooked up, and the addition of a test selector switch which selects the various parameters to be tested—each setting of the switch puts into the test circuit the proper power and instruments required to make the proper test. Four rapid changes of the switch position give in sequence a high potential test between all windings and windings to ground.

These improvements reduced the test time appreciably over existing methods. However, the system had disadvantages that could be overcome only by an automatic test set. The time for reading of meters was excessive. Too much was still left to the operator on the decision as to whether a reading was satisfactory. By 1961, if forecast production figures are accurate, four additional test setups would be required.

An automatic test station could indicate rejects immediately with the sound of a buzzer or bell, and, when the rejected unit is indexed out of a test station, it would automatically be pushed onto another side conveyor.

▶ Were Our Objectives Achieved?

Although new dies, tools, fixtures, and major investment costs were necessary for the new line of control transformers, the cost decrease in materials and substantial reduction of labor content of manufacturing justified the expenditures. The new construction lent itself well to semiautomatic and automatic processes, which permitted not only lower line costs, but greatly expanded production.

The complete line of 4-poster control transformers is now available. This shows rather vividly the extent of standardization of design accomplished. It took a period of over 2 years before the first units rolled off a somewhat unfinished production line. The new control line has gained wide acceptance by distributors and has given the Specialty Transformer Department a desirable product in this market.

In weight and volume the new G. E. transformer is 20 to 40 per cent lighter and smaller. The new design provides a much roomier wiring compartment and thus adds greater facility for the user.

Initial production indicates that in the areas where final facilities were installed, the rates and costs that were estimated are being achieved. Relatively few bugs were encountered and the percentage of rejects is running even lower than anticipated.

Though the results of this development appear very encouraging for the years ahead, this does not mean our job is done. We must continue to analyze our products to make certain we are getting maximum value from the materials and processes of production we are using. The search for new methods and new materials with which to better our present products is an unending one. Indeed, this aspect of engineering design is what makes the day-to-day job for the design engineer interesting and satisfying. Utilizing his ingenuity to the fullest, he contributes materially to the advance of engineering knowledge, solves problems heretofore considered unsolvable, and creates new products that look better, work better and are better.

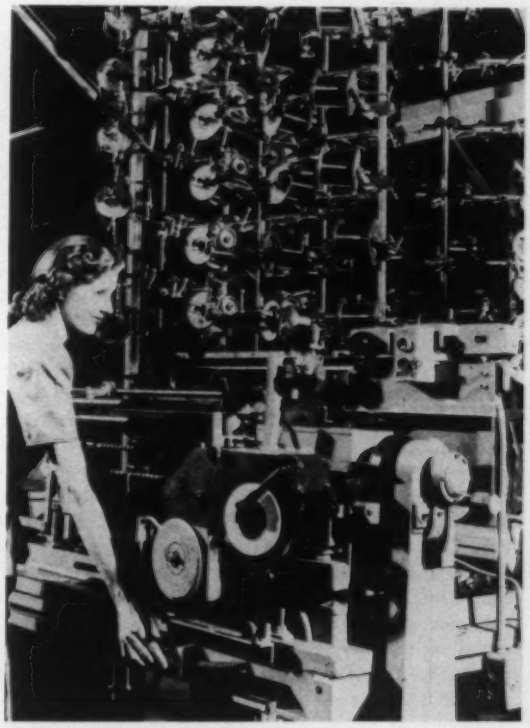


Fig. 3—Automatic coil winding machines for high speed operation help provide uniform transformer quality. Preliminary testing at this stage of production uses sampling technique.

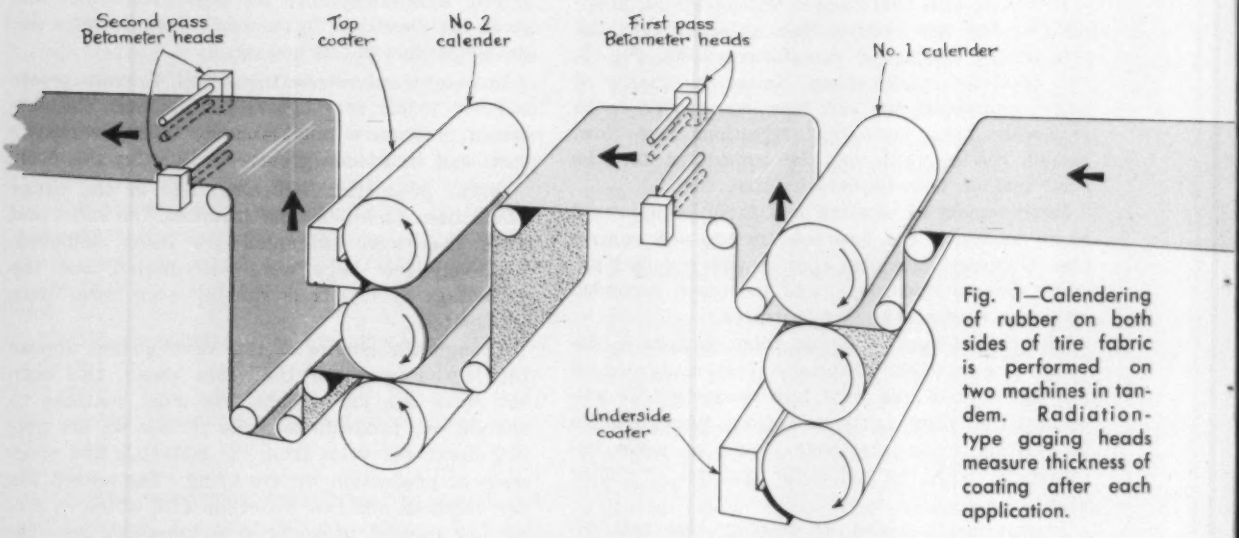


Fig. 1—Calendering of rubber on both sides of tire fabric is performed on two machines in tandem. Radiation-type gaging heads measure thickness of coating after each application.

RADIATION GAGES PROVIDE

AUTOMATIC CONTROL

RADIATION-TYPE gaging heads are the key to successful automatic control of thickness of rubber coatings applied to tire fabric at the Los Angeles plant of Goodyear Tire & Rubber Co. Eliminating hand sampling of a destructive and time-consuming nature, Isotope Products Betameters give continuous, accurate measurement of thickness and provide electrical signals by which instant, automatic corrective action may be applied to the calendering rolls.

Containing a strontium 90 radiation source mounted opposite an ionization chamber detector, the Betameter translates the radiation energy received by the detector into an electrical signal. When a material is placed between source and detector, the amount of radiation detected is reduced in direct proportion to the mass of the material. Calibration of the signal is thus easily made in terms of thickness of material or weight per unit area of fabric. In this installation, rubber coatings varying from ½ to 3½ pounds per square yard are measured with an accuracy of one eightieth of a pound. One advantage of the radiation principle is that there is no physical contact between gage and material; resilient materials such as rubber are easily deformed by contact pressure, and large errors possible with direct gaging means are thus avoided.

As shown in the diagram, *Fig.* 1, two calenders are arranged in tandem: one for applying the underside rubber coating to the tire fabric, the other for the top coat. Mounted behind each calender are twin Betameter measuring heads, *Fig.* 2, one on each side of the 60-inch web. In normal continuous gaging, the radiation source on each unit is exposed for a 14-inch length. Thus a large area of the web is sampled, and the point variations in the cord distribution are averaged out.

The electrical signals from the heads are fed to two twin-pen recorder-controllers on the central control panel, *Fig.* 3. When any measuring head signals an error in thickness, the proper screwdown motor on that side of the calender is actuated to effect a correction, the duration of which is proportional to the amount that the product is off-weight. The recorder-controller chart drives, which are operated by selsyn motors from idler wheels bearing on the web, pace the travel of tire fabric through the calenders. Tied in with each chart drive is a time delay device. This insures that the rolls will not be further adjusted in response to signals from the heads until after the effects of a first correction have been measured. The delay action also guards against the rolls being closed tight if no sheet is coming off the calender.

Other functions of the control panel include visual indication by means of lights of a variety of events such as whether a given sheet is light or heavy, or whether the radiation source is open or closed. An alarm horn is also provided. This sounds when any change occurs which is sufficient to throw the rubber sheet off specifications during automatic operation. In addition to their automatic control function, the Betameters can pro-

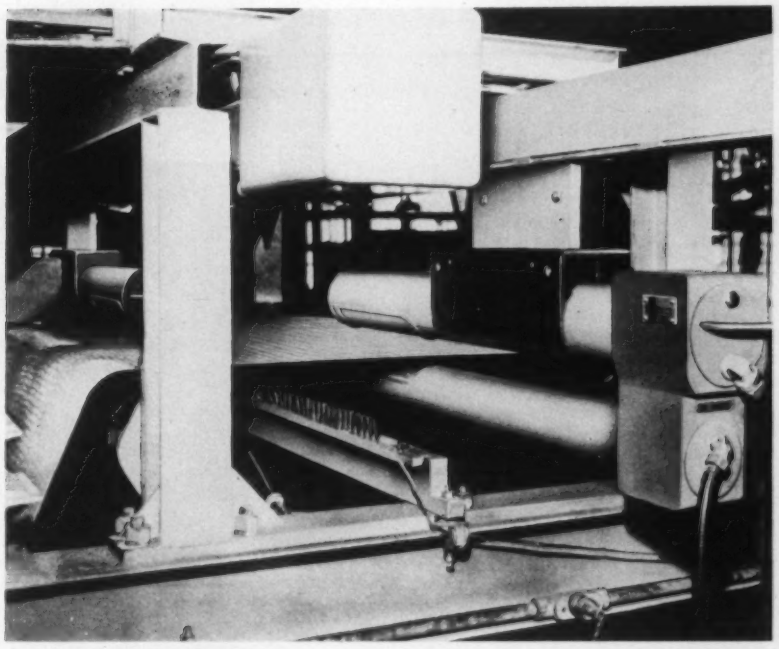


Fig. 2 — Closeup showing Betameter gaging heads mounted near each edge of the web behind first calender. Note absence of physical contact between gaging elements and web.

OF WEB THICKNESS

vide profile charts of the weight distribution across the sheet. When a switch on the control panel is thrown, one of the gage heads (which is normally positioned near the edge of the rubber sheet) traverses the entire width of the sheet. At the same time, a shutter closes the 14-inch radioactive source used for automatic control and opens a half-inch source. This small source accurately defines the profile and records it on the chart.

Two separate means are employed to stabilize the overall system. These are "balanced operation" and automatic standardization. "Balanced operation" means that for every measuring source and detector head, there is a balancing source and detector head mounted inside the instrument. This stabilizes the dc signal amplifier, eliminates the effects of atmospheric pressure and temperature and corrects for decay of the radioactive source. It does not, however, correct for such changes as the buildup of dust on the thin windows of the detector. Automatic standardization looks after this. Every 30 minutes, the gage heads are automatically retracted from the web and the iris is adjusted until the instrument zeros on a standard sample.

With the improved control of the weight of rubber calendered onto tire fabric, production runs of tires are being made closer to design standards than ever before. Side-to-side as well as lengthwise weight variations have been reduced, and sieges of overweight material formerly experienced have been eliminated.

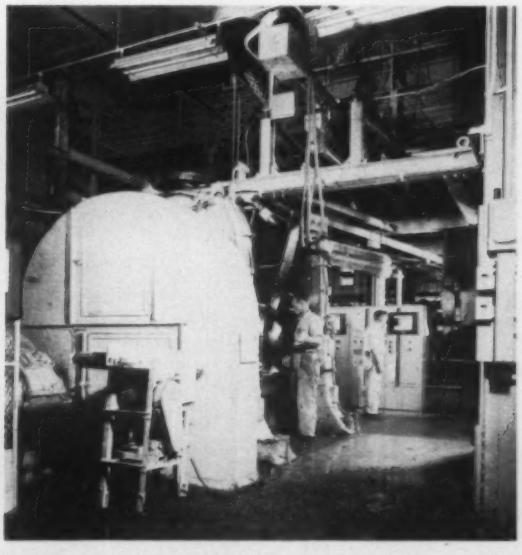
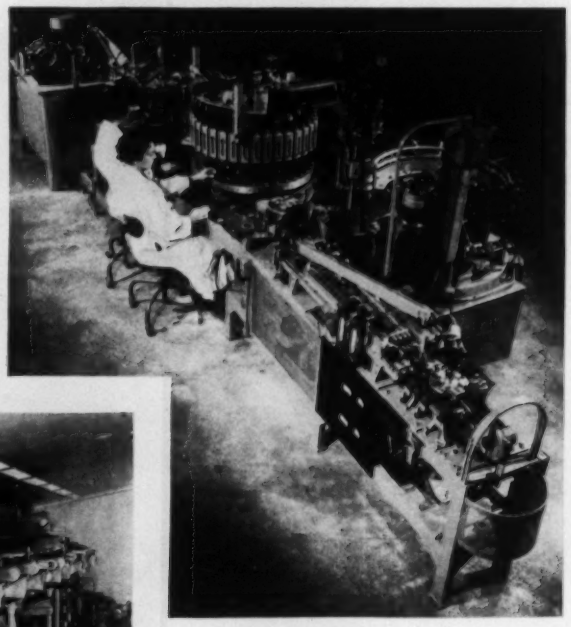
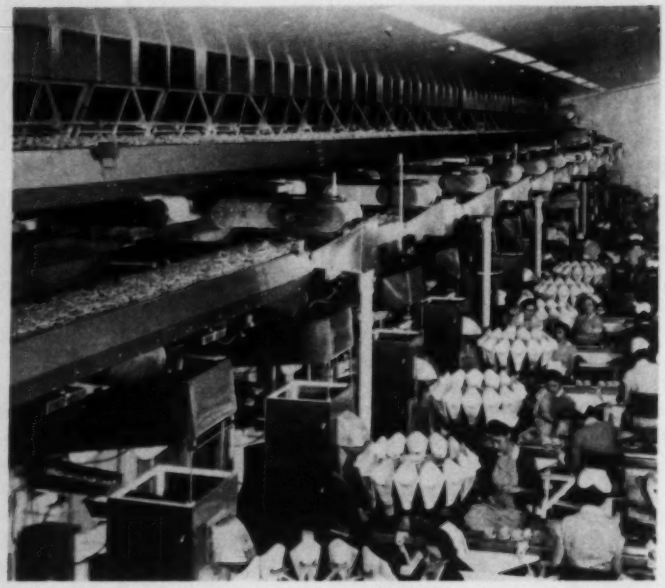


Fig. 3—Electrical signals generated by the Betameter heads are fed to control panel in background. Signals activate calender roll screw-down motors to control thickness. Recorder-controllers also provide permanent record of coating thickness.

Diode Assembly

ASSEMBLY equipment for the production of glass enclosed diodes is used by CBS-Hytron, electron tube and semiconductor manufacturing division of Columbia Broadcasting System Inc. Operations involving the assembly of wire, glass and semiconductor crystals have been broken down into six elements, performed by separate machines which are inter-connected by automatic transfer mechanisms. Two sections of the grain-sized assembly feed in toward the center of the machine where they are fused together into a completed product. The devices are then tested automatically. Biggest savings with machines are in reduced labor and scrap—items that normally account for approximately 25 per cent total cost of diode manufacture. With further design standardization the company anticipates manufacturing costs can be reduced to about one half the present level by the installation of additional automatic machinery.





Food Packaging

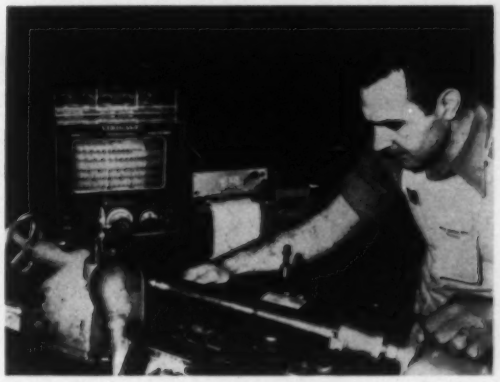
OPERATIONS at Frito Co. depend upon a conveyor belting which can withstand the detrimental effects of warm vegetable oil. B. F. Goodrich's Koroseal belts have reduced belt maintenance 50 per cent over previous materials used. Product fresh from the oven area is directed along two main conveyor belts at speeds of 30 fpm. At 24 points along the belt, feeder belts are supplied with the product which is then conveyed to the packaging machine. Subsequently the packaged product is directed through a heat-sealing process, completing the packaging operation. Of special interest to the food industry, the belt surface is easily cleaned of food particles which might support bacteria growth.

Production Welding

CARBON DIOXIDE welding process developed by Westinghouse is used at Ford in the manufacture of rear axle housings. Banjo, banjo cover, and flanges are joined into an assembly at welding speeds up to 140 inches per minute. In the carbon dioxide process, the gas forces normal atmosphere away from the weld area, essentially performing the task of powdered flux in a submerged arc process. Increased welding speeds and reduced material cost are the advantages of the new process. One Ford plant uses 71 Westinghouse welding heads on 31 automatic welding fixtures supplied by Agnew Electric Co. and Expert Welding Machine Co.

In action

Inspection and Control



ULTRASONIC test equipment developed by Branson Instruments Inc. can be used to activate compensating controls in production and inspection operations. By attaching gating circuits, which determine whether a strong signal is present within a preset frequency range, it is possible to establish high and low thickness tolerances. Thickness changes on the order of 0.05 of 1 per cent can be sensed in metals and plastics. Thicknesses as small as 0.005 inches can be inspected. The output of the gating circuit can be applied to a potentiometer-type strip chart recorder for visual indications and the signal, after amplification, may be used also to control machining processes or to make corrective adjustments.

Warehousing Control

EXTENSIVE mechanized warehousing operation has been designed by the Dasol Corp. for Mangel Stores. Pictured is point in system after order has been picked and packed—operations characterized by a variety of goods being moved on conveyors and automatically accumulated for shipment to common points. At point shown, operator notes code number of store written on carton; when number is punched into control panel, a light identifies the address stencil to be placed on the carton. Operation of control panel automatically checks previously determined weight of carton and also sets up the memory control that subsequently directs each carton automatically through a conveyor system to the point where it is loaded onto desired carrier.

Tape Manufacture

MAGNETIC TAPE in 24-inch wide strips is dried in a special oven engineered by Minnesota Mining and Mfg. Co. Prior to this operation at the company's new Hutchinson, Minn., plant, a mixture of magnetic oxide and solvent has been applied to the specially treated backing material—either cellulose acetate or polyester film. The most critical process in manufacture of magnetic tape is the coating operation. As an example, a smooth layer of oxide is applied within tolerances of plus or minus 0.000009 inches in the manufacture of video recording tape. The dried 24-inch wide web is wound on large rolls and later slit and wound on smaller individual reels ranging from ¼ to 2 inches in width or special larger sizes. The new 3M plant is a major production unit for all magnetic tapes for video recording, computers, instrumentation and guided missile work, geophysical exploration and automation, as well as the professional and home sound recording fields.

LIQUID HANDLING SYSTEM FEATURES

AUTOMATIC FLOW CONTROL

HANDLING BEER in can and bottle filling operations presents some problems not usually encountered with other fluids. For example, uniform filling of the containers depends not only on the maintenance of a constant level of liquid in the filling machine reservoir, but also on the control of foaming of this highly carbonated beverage. Thus, successful handling requires a pumping system that is sensitive to demand from the fillers, quick in response, yet extremely gentle in action.

In one western brewery such a system, diagramed in *Fig.* 1, employs standard variable speed fluid power transmissions and pneumatic control devices to drive and control positive displacement beer pumps. Precise control of liquid level and head in the reservoirs is necessary to avoid over and under filling of the containers. Because the capacity of the reservoirs in the fillers is small compared with the flow demand on them during full-speed filling periods, the level is very sensitive to the inflow, the outflow, and to the quantities of beer in the reservoirs and in the storage tanks.

Beer is pumped from the storage tanks, *Fig.* 2, to the reservoirs in the bottle and can filling machines on the floor above. Driving the pumps are Oilgear two-way, servo-controlled variable hydraulic transmissions. Pressure inside the filler reservoirs, which is a gage of liquid level, acts on pneumatic controllers associated with each machine to generate low-pressure air signals. The signals—small for low liquid levels, larger for above-normal levels—are fed back to the servo controls on the hydraulic transmissions. Thus instantaneous, automatic correction of liquid level is effected by actuating the transmissions to increase, decrease, reverse or stop the rotation of the beer pumps as required by the fillers.

Formerly the beer was throttled into the reservoir, which resulted in foaming and irregular liquid level. With the new system, level is held within 1/16-inch of the desired point and foaming is controlled. Other benefits of this system are that the beer pumps may be flushed under water pressure without disconnecting the drive, and the pumping unit itself can be washed down externally to maintain sanitary conditions in the brewery. The Oilgear drives feature automatic protection against overloads which exceed a preset torque. Several years of continuous service have proved the system to be dependable under all conditions and with little or no attention.

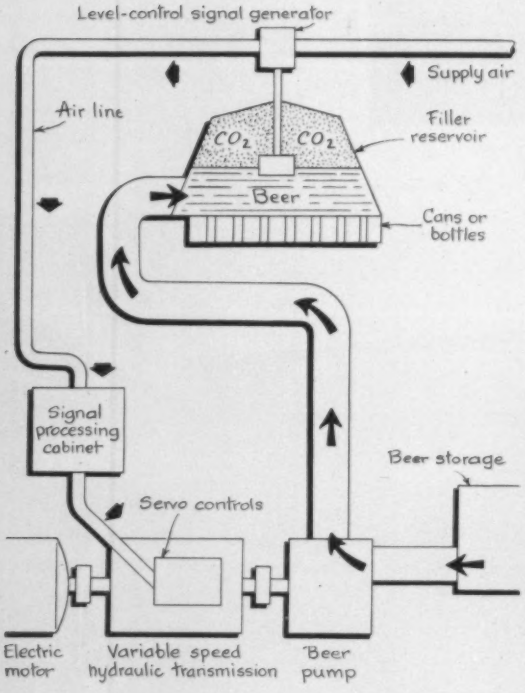


Fig. 1—Schematic diagram of automatic can and bottle filling system for beer. Pneumatic signals derived from pressure in filler reservoir actuate pump drive to control liquid level for uniform filling of containers.

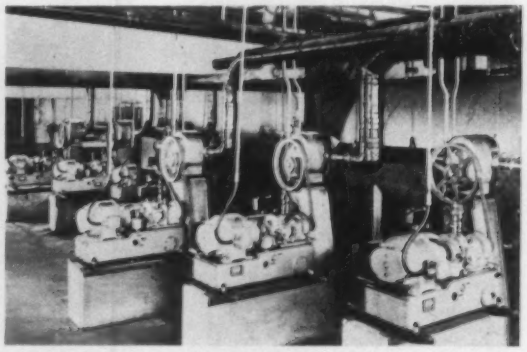
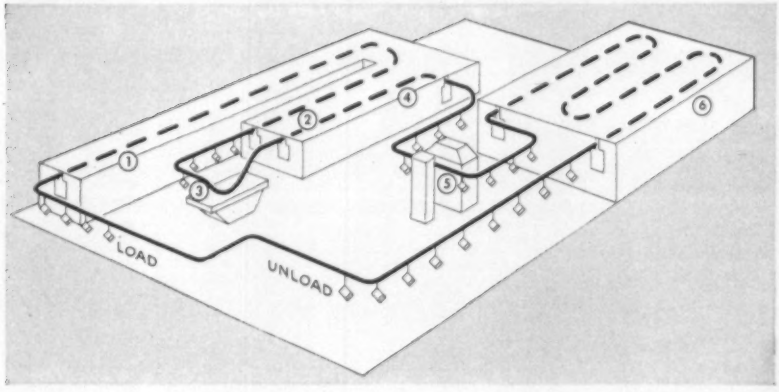


Fig. 2—Battery of six pumping units delivers beer from storage tanks to can and bottle filling machines on floor above. Variable speed, reversible pump drives adjust flow in response to demand from the fillers.

New and expanded line of equipment from DeVilbiss



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3. Dip Tank
4. Prime Coat Bake Oven
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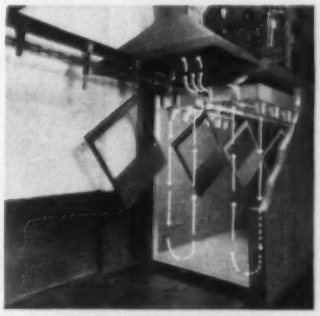
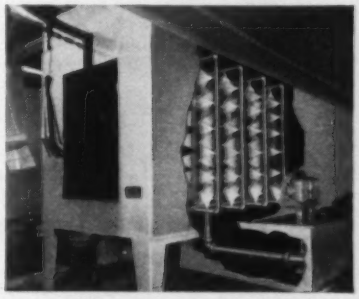


NEW! Industrial Ovens



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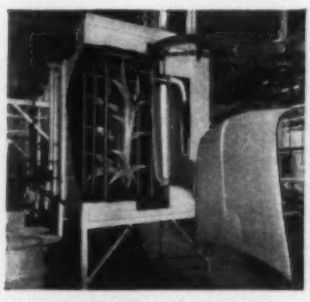
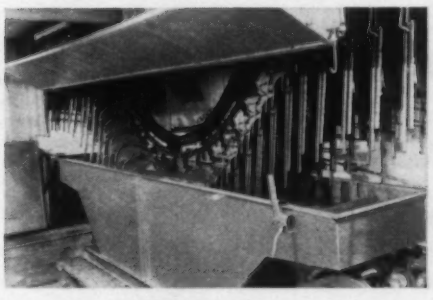
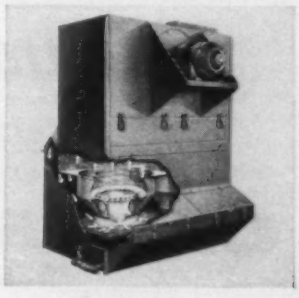


NEW! Flo-Coaters



NEW! Dip-Coaters



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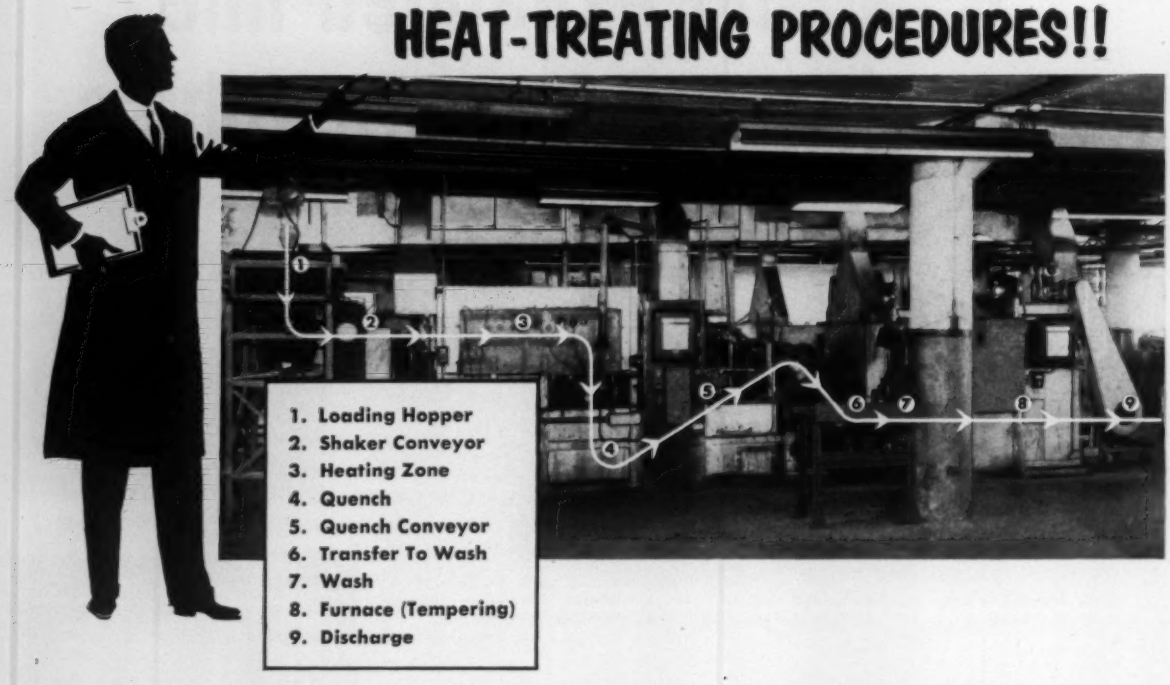

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AUTOMATION

new equipment

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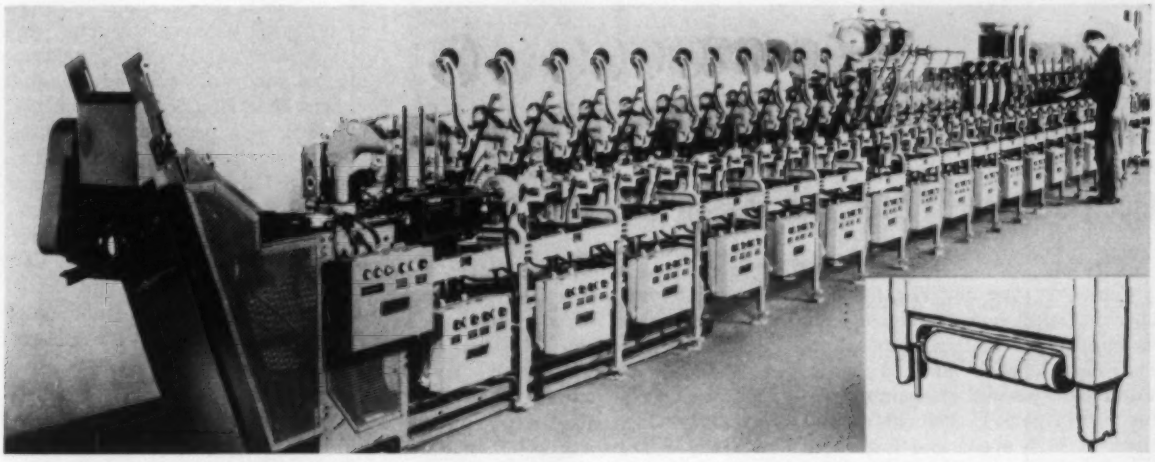
For detailed information and literature, use card page 17



Automatic Assembly Conveyor for Printed Wiring

MECHANIZED production, to be satisfactory must equal or surpass corresponding hand operations in reliability of operation and quality of work, and be adaptable to wide variation in the product design. With this in mind, **United Shoe Machinery Corp.,** 140 Federal St., Boston, Mass. has designed an automatic conveyor for the assembly of components to printed wiring boards. Machines feed, prepare the component for insertion, insert and clinch it.

Sequence of Operation

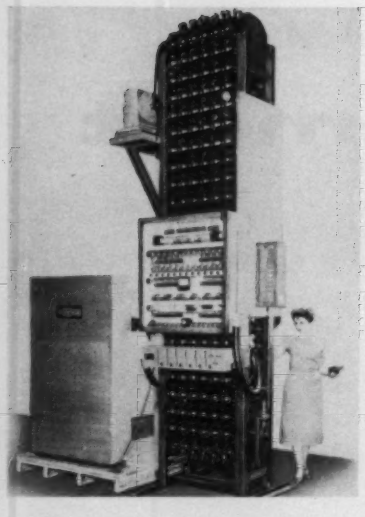
An in-line type conveyor has a continuous belt which moves the work from one station to the next. Pallets carry the PW boards along the conveyor and provide the accurate locating means required in this type of equipment. PW boards are automatically loaded onto the pallet at the first station by a board loading machine and are held in place by means of pins and spring clips. As the board moves down the line, the completed assembly is removed from the pallet by the machine, and the pallet is carried off the belt and returned to the storage chute at the head end of the conveyor. The underside of the main conveyor belt loop is used for this return trip. On a signal from the master control switch, a pallet is released from the storage chute to the pallet return escalator which transports the pallet to the main level of the conveyor in position for the next cycle. An attendant keeps the board loading station supplied with boards and each machine supplied with components.

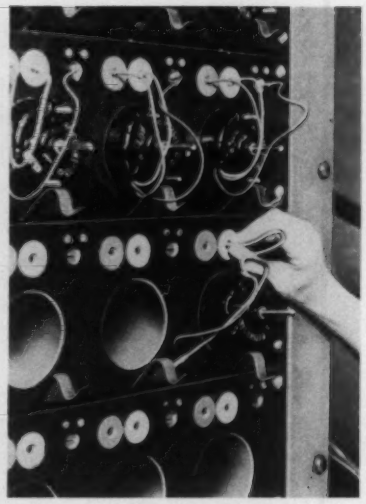
Flexibility of the Machine

The building block technique is the basis of the Dynasert system. Additional units to the original conveyor can be made by breaking the conveyor and inserting intermediate sections for the equipment to be put on the conveyor as required. Each intermediate section provides the mounting space, control circuits and necessary disconnect fixtures for two machines. Insertion machines can be switched around or replaced temporarily with alternate types. Realignment of machines to different settings is rapid and easy. A machine is repositioned quickly by releasing the base clamp, moving to the position desired and reclamping the machine. Replacing one machine with a spare involves, in addition to the base clamp, breaking three quick disconnect fittings and sliding the machine off the conveyor.

For volume work, a series of machines can be arranged in any desired sequence on a conveyor. The boards move along the conveyor on pallets, stopping automatically at each machine. Production rate is 9600 assemblies per 8 hour day. —*Circle 401

*For Inquiry Card, see page 17





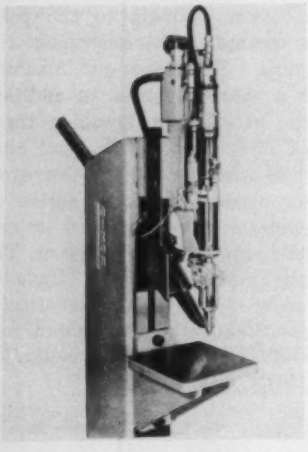
Electric Motor Tester and Run-in Machine

Item 402

Conveyor type unit is capable of checking electrical equipment such as car heater motors, generators, distributors, coils and regulators. Equipment provides 15 minute motor run-in period, then instrument tests at high speed and low speed and automatically shuts off defective motors. Production rate is 1000 motors per hour. Device performs specific tests; for grounds, open circuits and shorts. Ground test is capable of an insulation test for almost any degree of moisture.

Motors are manually loaded into fibre glass receptacles arranged six to a panel or rack. Motor wire leads are inserted in color-coded connects. At the opposite side of the machine, acceptable motors are carried by belt conveyor to a painting operation while rejects are conveyed to repair.

Stationary run-in rack holds 60 motors, has an automatic test for grounds which can be used if the vertical conveyor fails. It also allows a double check on repairs. The dc power for both units is provided by a selenium rectifier. An argon gas tube at the right of the panel is visible to maintenance men, warning them of any current remaining in the machine after power is shut off. Lights immediately identify the particular circuit defect. **Michigan Production Engineering Co.**, 1796 E. Nine Mile Rd., Hazel Park, Mich.
—*Circle 402

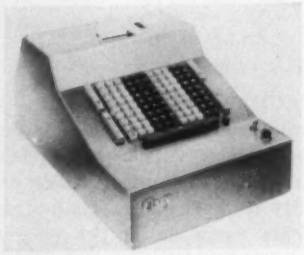


Screw Driver

Item 403

Unit is capable of driving screws and nuts up to 5/16-inch thread size at speeds up to 60 per minute. Air motor with adjustable torque range from 10 to 108 in.-lb has a sensing device which stops the machine when a screw or nut is not placed or properly torqued. Motor mounting allows easy interchangeability for different driving units for various applications. Unit is tooled to suit a variety of screw head and nut designs. It is equipped with a precision-built, adjustable, cushioned air cylinder for shock-proof deceleration, has a one-piece superfinished piston and rod.

Model SD-1 operates at 2000 rpm and has a 3-inch stroke, with other speeds and strokes available to suit special requirements. In operation, a solenoid pilot valve initiates the cycle with an automatic control signal to operate return poppet when screw or nut is properly torqued, stopping motor and retracting driver to complete cycle. If a screw is not placed or properly torqued, automatic sensing device interrupts the cycle, preventing damage to tools and equipment. Full electrical controls are included with provisions for automatic interlocking. Circuits operate on 110v, with all connections located in a master junction box. Compact manifold contains adjustable valve for speed control. For electrical adaptation to automatic assembly, a small double-pole, double-throw relay in the control circuit and an electrical signal can be added. **Dixon Automatic Tool Inc.**, 2300 23rd Ave., Rockford, Ill.
—*Circle 403



Scanning Printer

Item 404

Self contained unit is capable of converting a parallel set of decimal contact closures into a printed digital record. Printer consists of one solenoid per order which is activated under control of a commutator located on the machine that scans the closures to be printed as the machine cycles. The number of leads between the printer and the device being read can be a maximum of 25. Maximum printing capacity is 12 digits per line with a minimum printing rate of three lines per second. **Clary Corp.**, San Gabriel, Calif.
—*Circle 404

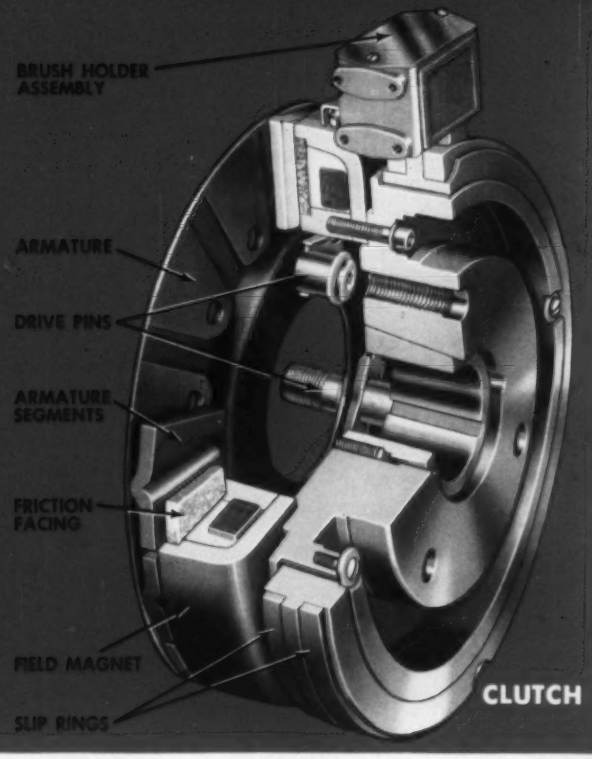
*For Inquiry Card, see page 17

Circle 686 on Inquiry Card→

The New EATON Dyna-torQ

MAGNETIC-FRICTION CLUTCHES, BRAKES, CLUTCH-BRAKES, CLUTCH-COUPLINGS

Are the Accurate, Trouble-Free Means of Controlling Power and Motion in Modern Stop-and-Go Machines



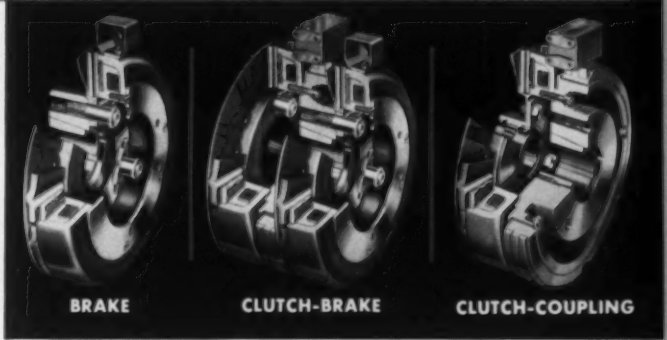
CLUTCH

The Eaton Dyna-torQ electro-magnetic friction units include a number of unique design advancements which provide longer life and superior performance with less maintenance. Check the following important advantages:

1. **Extremely Rapid Response in Clutching and Braking**—makes Dyna-torQ units ideally suited to a wide range of manual and automatic cycling applications.
2. **Smooth, Shockless Engagement**—permits rapid operation without backlash or chatter.
3. **Highly Effective Cooling**—maintains lower operating temperatures; permits fast, repetitive actuation.
4. **Self-Adjustment**—automatically maintains proper clearance between armature shoes and field magnet.
5. **Simple, Accurate Control**—manual or automatic; may be had to operate on 110, 220, or 440 volt, 60 cycle, alternating current.
6. **Low Maintenance Costs**—result from unique design features and superior quality of construction, assuring long operating life and minimum down-time.

Eaton Dyna-torQ Clutches and Brakes are electrically operated, disc-type friction units having two basic components: a field magnet and an armature. Torque is transmitted as the magnet pulls the armature into engagement. Because the pull of the magnet is direct without intricate linkage, and the movement of the armature is slight, Dyna-torQ units are capable of extremely rapid response in clutching or braking.

Ask us to tell you how these Dyna-torQ units will fit your equipment.



BRAKE CLUTCH-BRAKE CLUTCH-COUPLING

EATON®

WIDE RANGE OF SIZES AND CAPACITIES

Send for Illustrated Descriptive Literature

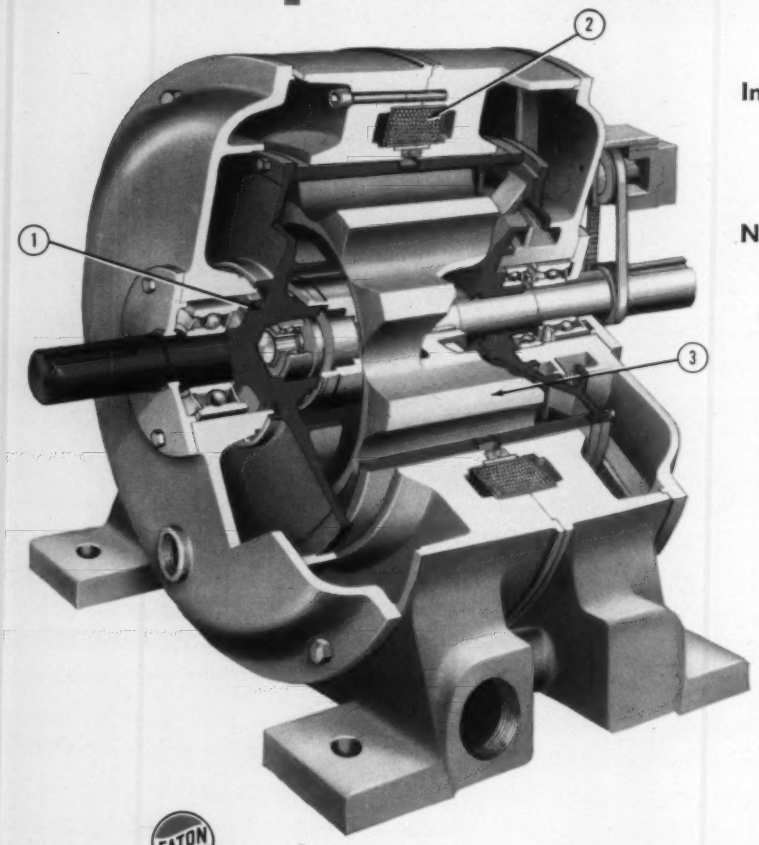
EATON

DYNAMATIC DIVISION

MANUFACTURING COMPANY

3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

Want Speed Control Like This?



Infinitely adjustable speed from AC power source

★

Wide speed range

★

No commutators, rings, brushes, or rotating coils

★

Instantaneous response

★

Remote control

★

Low power losses

★

Quiet, efficient operation

★

Simple construction

★

Low maintenance cost

1. Input Drum Assembly
2. Stationary Field Assembly
3. Output Rotor Assembly

EATON

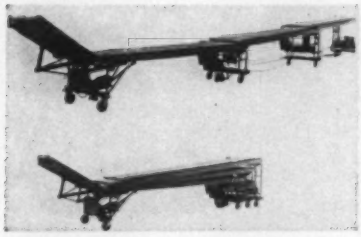
DYNAMATIC®

Eddy-Current Equipment is the Answer!

Dynamatic Eddy-Current Drives, Couplings and Brakes are the solution to difficult speed control problems—in both original equipment and factory installations. Smooth, stepless acceleration and deceleration are achieved without mechanical contact between rotating members. Eddy-current braking provides cushioned, controlled stops. Dynamatic electronic or magnetic amplifier controls, in conjunction with these units, assure wide latitude in operating functions. For efficient, economical speed control, investigate Dynamatic Eddy-Current Equipment.

Send for Illustrated Literature Describing Dynamatic Eddy-Current Equipment

EATON MANUFACTURING COMPANY
DYNAMATIC DIVISION
3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN



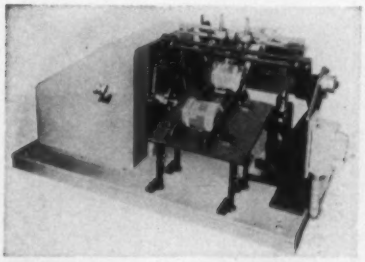
Telescopic Conveyor

Item 405

Unit is adaptable for handling bag-packed materials such as sugar, flour, tobacco, mail and other commodities not conveyed by gravity. Goods are transported in either direction. Telescopic feature allows conveyor to follow the load into trailers and box cars.

Conveyor is available in 2, 3, or 4 sections from 10 to 16 ft long. Belt widths are 10, 20 or 30 inches. The conveyor is mobile and telescopes by power drive. The belt on each section is driven by a separate motor. Loads up to 300 lb per lineal foot are handled. Differences in level between loading dock and trailer bed are automatically accommodated by the pivotal action between sections. **Wilkie Co.**, 5520 Arch St., Philadelphia 39, Pa.

—*Circle 405



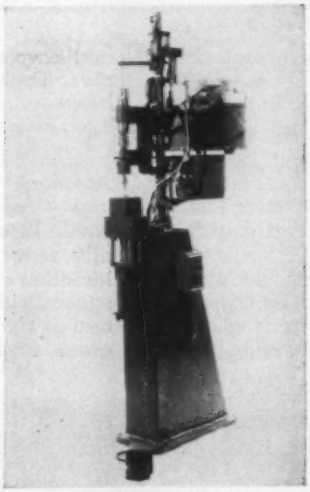
Marking Machine

Item 406

Unit capable of printing color, contents, tradename and other variables on paint cans, food containers, cosmetic jars and similar heavy items. Model 64AC allows continuous operation in filling and sealing lines. An intake chute equipped with adjustable guides has an escapement which automatically lines up containers in printing position. Controlled ejection of printed containers onto the ejection chute permits continuous flow into the packing line. Production rate is 20 to 70 units per minute, depending on the weight and size of the container.

Variables can be repetitively imprinted on a panel all the way around a can, eliminating register problems. Rubber plated printing elements are designed for sharp clear imprints, long working life, and quick interchangeability. **Markem Machine Co.**, Keene 68, N. H.

—*Circle 406



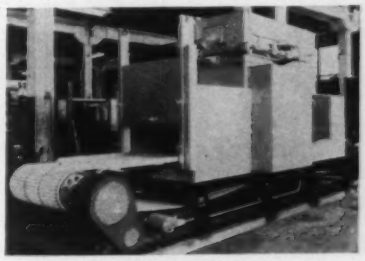
Pin Riveter

Item 407

Unit designed for delicate lugs, studs and pins, assures continuous single-stage loading in a rapid automatic cycle as low as 2+seconds. Anvil and loading mechanism prevents the small lugs from misloading. Steel base houses machine time and cycle controls and a baffle chamber for exhaust air. Units are equipped with custom hopper feeding units for specific lugs in sizes to ⅛-inch, hollow or solid, made of material such as silver, copper, brass, mild steel. Lugs can be of any shape if projections are suited to hopper orienting.

Impact frequencies range to 16,000 bpm, rotation of the spindle is approximately 500 rpm. Machine is powered by 110v and 40-80 psi air pressure. Riveter can be adjusted for force and rate of impacts, duration of impacts, feed speed and depth, anvil loading speed and hopper frequency and feed flow. **Lemert Engineering Co. Inc.**, 201 E. Jefferson St., Plymouth, Ind.

—*Circle 407

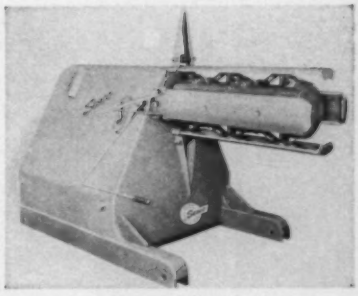


Conveyer Oven

Item 408

Device conveys products through an oven for drying and baking processes, dehydrating and baking-on finishes. Heating zone is gas fired with maximum temperature of 450 F. Continuous belt is driven by an electric motor. Speed of belt is adjustable from 2 ft to 10 ft per minute. Oven is equipped with counterbalanced doors at each end. Loading and unloading extension on each end holds the product being processed. Units are available for heating by gas, electric or steam. **Grieve-Hendry Co. Inc.**, 1401 W. Carroll Ave., Chicago 7, Ill.

—*Circle 408



Centering Reel

Item 409

Unit is capable of handling coil weights up to 30,000 lb on a single spindle. Contoured four jaw expanding arbor is power driven and allows for variations of inside coil diameters up to 6 inches. Proper relationship of the expander jaws

*For Inquiry Card, see page 17

Next Page Circle 679→

CLEVELAND TRAMRAIL ...

a Leader in AUTOMATION

of Materials Handling for 30 Years

Automation as applied to overhead materials handling equipment is not new or magic to Cleveland Tramrail. For 30 years, we have engineered a wide variety of installations for handling materials automatically.

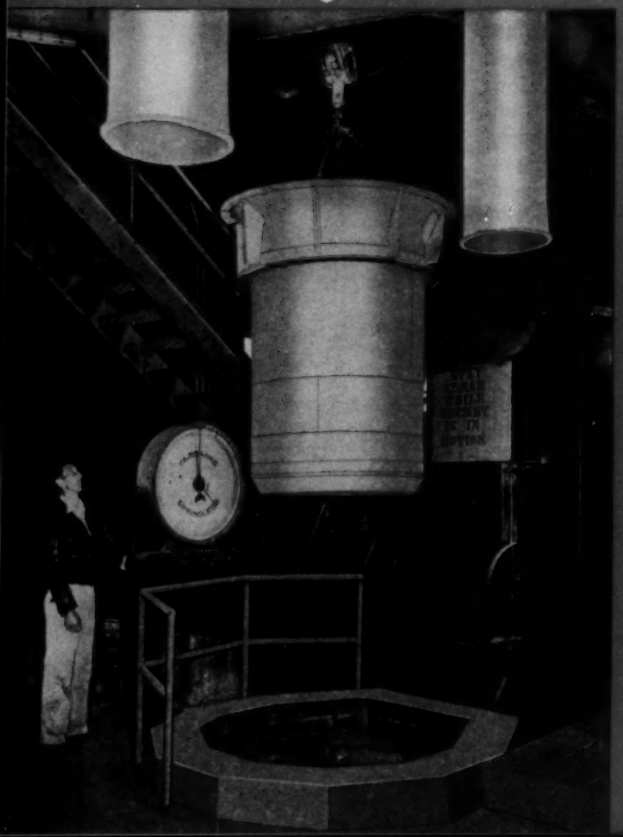
In operation today are Cleveland Tramrail installations that shuttle between two points delivering loads without need of operators — systems that dispatch materials to any of a large number of stations, as selected, empty and return, entirely automatically — equipment that is on the move all day long accumulating and delivering without any attendants whatsoever. The systems vary in type, size and complexity and have from one to hundreds of load-hauling carriers. They operate between points within a room, between floors of a building, outside between buildings, over roof tops and even over public highways.

TREMENDOUS SAVINGS

Automatic Tramrail systems enable tremendous savings — usually enough to completely pay for them within 12 to 18 months, or less — because they drastically reduce the man-hours required for materials handling and permit making the best use of building space. Widely separated operations can be integrated and carried out as though located adjacently. Remote areas, otherwise wasted, can be utilized efficiently.

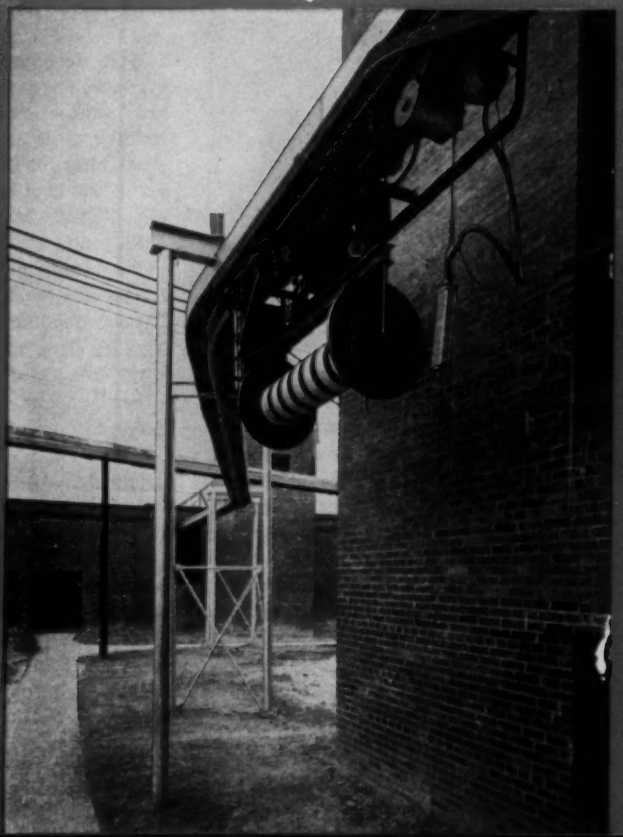
AUTOMATIC FURNACE CHARGING

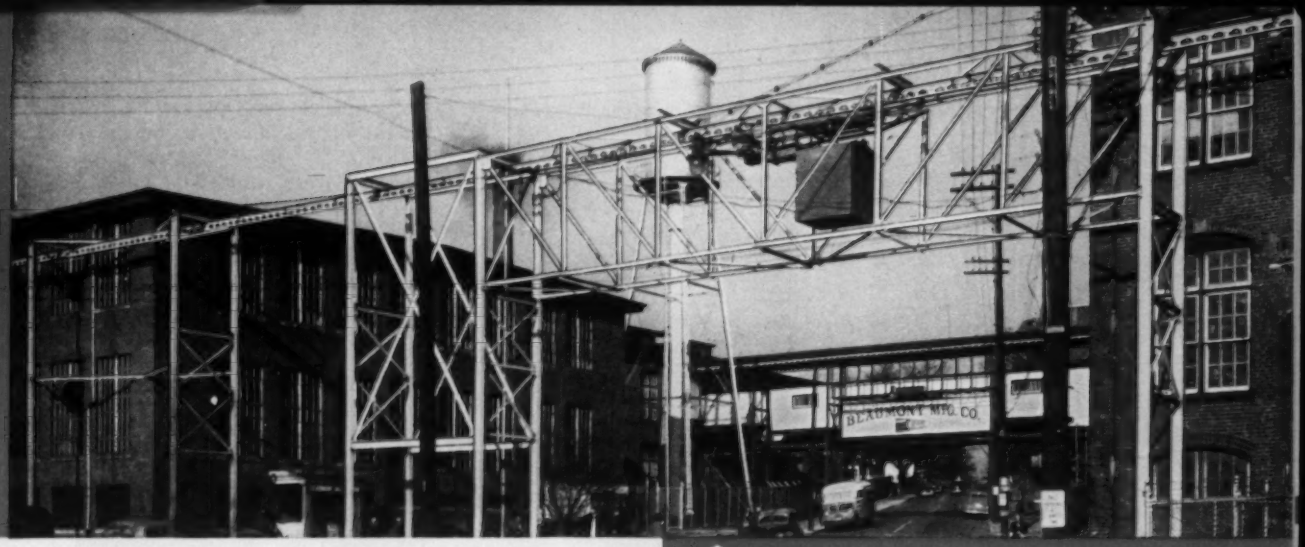
Buckets with 2,000 lbs. of charge materials are delivered from weighing scale on one floor to melting furnace at an upper elevation, emptied and returned automatically by means of a Cleveland Tramrail Automatic Dispatch System.



AUTOMATIC TEXTILE BEAM HANDLING

80 man-hours are saved weekly by a Cleveland Tramrail Automatic Dispatch System which operates between two buildings, delivering beams directly from warpers to slashers without anyone accompanying.





Floor traffic — and frequently materials storage — can be transferred to ceiling space and thus effect savings in floor area and facilitate handling.

Regardless of the nature of your business, most likely the principles of automation can be profitably applied to the handling of materials in your plant. With a wealth of experience in this field, Cleveland Tramrail engineers stand ready to serve you. Your inquiries are invited without obligation.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1386 EAST 284th ST., WICKLIFFE, OHIO

AUTOMATIC HANDLING OVER HIGHWAY

Materials are carried back and forth between buildings located on both sides of a principal thoroughfare by automatic dispatch carriers which operate on three Cleveland Tramrail track systems.

AUTOMATIC STEEL SCRAP DISPOSAL

One carload of metal chips is picked up daily and moved to a bin at a railroad track by an automatic magnet-carrying system. The scrap comes from metal-cutting machines on floor above. The system is in operation 12 hours a day without attendants.

AUTOMATIC SAND DISTRIBUTION

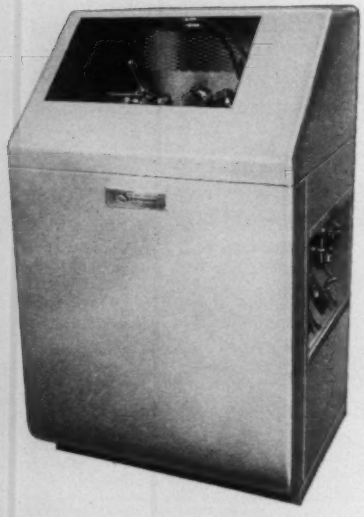
Sand is distributed in a foundry from the muller to molders' stations by a Cleveland Tramrail System which has a 24 cu. ft. bucket that travels on a double track and discharges wherever sand is called for.

AUTOMATIC PAPER SCRAP HANDLING

A carrier with two buckets delivers scrap paper cuttings from the first floor to 15 bins on the top floor. When the carrier reaches a pre-selected station it stops and bucket empties by turning. Carrier then proceeds to bin selected for second bucket. After it has emptied, carrier returns to starting point.

to the main spindle is maintained by the use of guide pins. Cantilevered stock support has tapered roller bearings spaced in proportion to the coil width. Tapered roller bearings and expander mechanism of the arbor are housed in a sealed oil bath. Air brake prevents coil overrun.

Unit is powered for rotation or with a free running spindle for a pull-off method of uncoiling. Electrical controls include pushbutton start, emergency stop, inch forward, inch reverse, expansion and retraction. **Sesco Inc.,** 8881 Central Ave., Detroit 4, Mich.
—*Circle 409



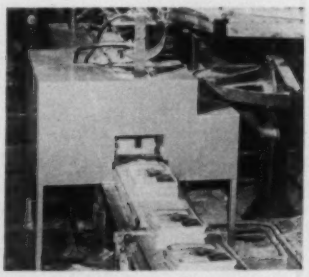
Painting Machine

Item 410

Units designed for mask painting small jobs or decorating jobs involving a wide variety of shapes and contours. The automatic spray-mask painting machine can be adapted to handle more than one part or one color at a time as a multiple-station, or a multiple color unit.

Series 5M has seven standard models for continuous high speed production from the simpler types of spray-mask painting operations to the complex and exacting types.

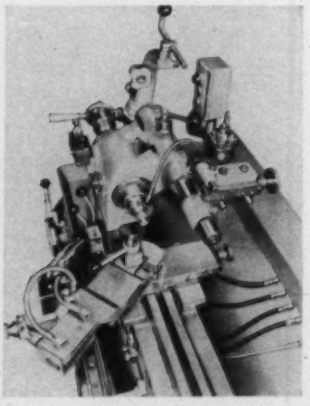
Air operated for safe and simple installation, all units are completely contained in a standard lightweight, portable cabinet which serves as its own spray booth, and can be easily repositioned when rearranging production lines. **Sepanski & Associates,** 900 Clancy Ave., N.E. Grand Rapids, Mich.
—*Circle 410



Counter-Stacker

Item 411

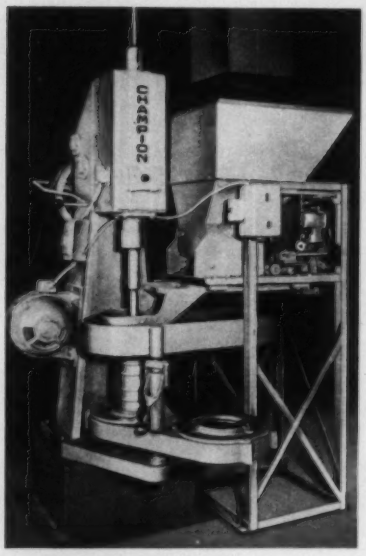
Unit automatically counts and stacks a predetermined number of magazines or books. Machine is electrically controlled and pneumatically operated. Any magazine removed from the operation at any point from the gatherer to the delivery belt of the counter-stacker does not affect the count in the stack and no resetting or retiming is necessary. Device is adjustable in width and length for any size publications and can handle 8700 books per hour. **Taylor Counter & Stacker, Popular Mechanics Co.,** 200 E. Ontario St., Chicago 11, Ill.
—*Circle 411



Tracer Lathe

Item 412

Unit duplicates piece parts from flat or round templates with an accuracy as close as 0.0003-inch. Pushbutton starts automatic cycle of carriage and spindle; stops cycle and returns carriage to starting position with tool and stylus retracted. Motor direction and speed are controlled by the spindle drive control levers mounted by the headstock control. Longitudinal feed is controlled by a lever on the control panel and actuates a pressure compensated valve regulating the carriage feed rate. **Elgin Tool Works Inc.,** 1770 Berteau Ave., Chicago 13, Ill.
—*Circle 412



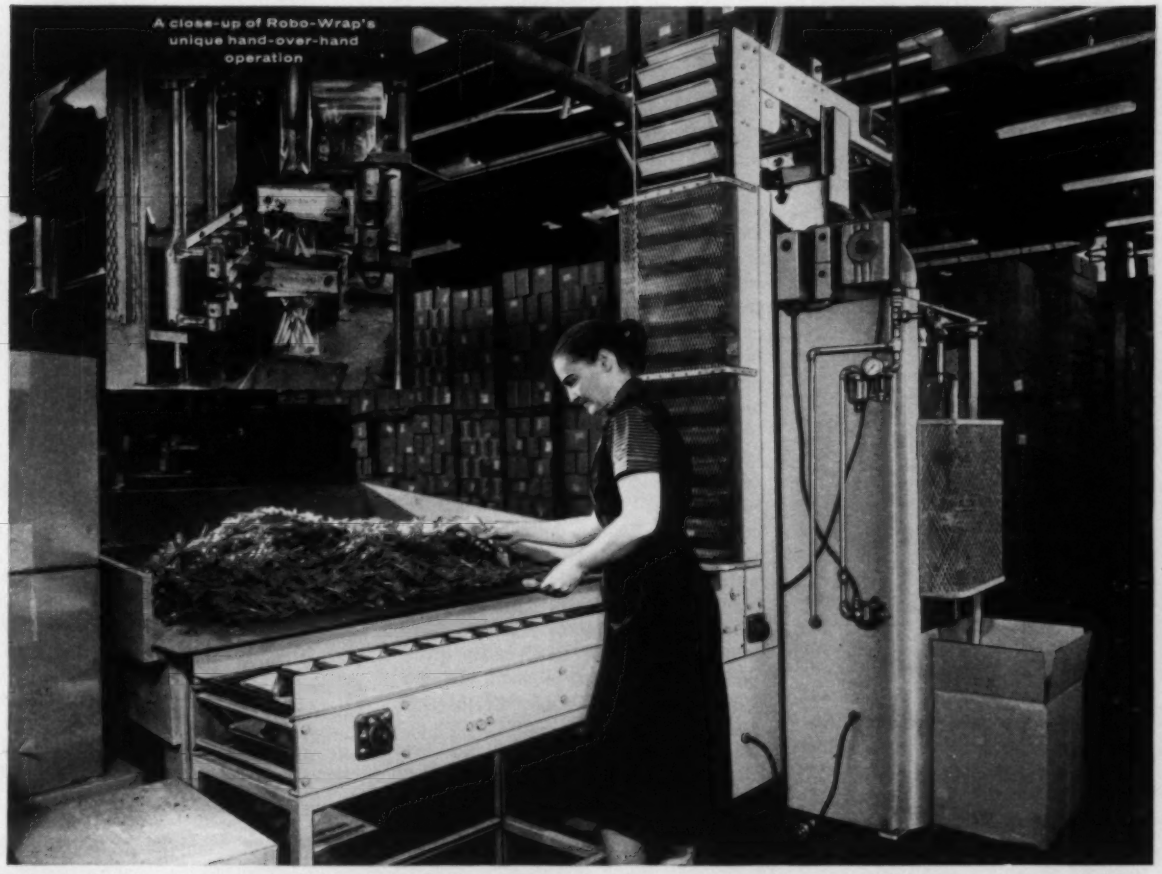
Drain Tile Machine

Item 413

Machine makes concrete drain tile in a range of sizes from 3 to 12-inches in diameter. Mixed material from the automatic feeder's hopper flows to the hopper table in front of an impeller. The impeller directs a horizontal flow of the material to the shuttle on the feeding table of the machine.

Length of the impeller stroke is adjusted according to the amount of material required in the shuttle for making different size tile. The shuttle is constantly agitated during feeding, so that the mixed material is thoroughly shaken into position within the casing. Both impeller and shuttle are stopped during the packing operation by two limit switches. Mixed material is compacted in the mold by a packer head rotating at 500 rpm. As the packer head comes out of the mold, the excess material is

*For Inquiry Card, see page 17



PACKAGING FLEXIBILITY PAYS OFF AT FEDERAL

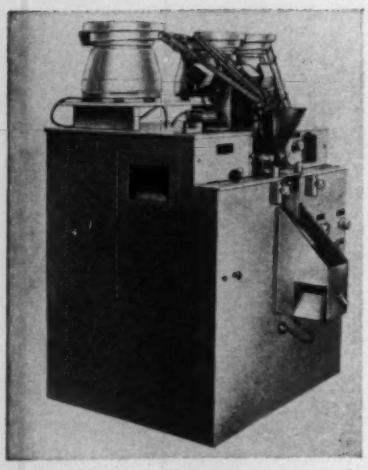
A Lynch Robo-Lift elevating conveyor and a Lynch Robo-Wrap automatic unit packager combine to reach new production highs, lower packaging costs for the Federal Tool Corp., Chicago. Requiring but one operator, the integrated team produces an average of 45 packages a minute ... has the flexibility needed for quick changeover from one size to another. Manually fed, Robo-Lift takes the product "up 'n' over" for fast Robo-Wrap package forming, filling and sealing—all in one continuous action. The hard-working, Robo-Lift—Robo-Wrap team operates three shifts a day, six days a week... has logged just nine hours downtime in three months! Learn how Robo-Lift, Robo-Wrap packaging can serve you ... bringing lower maintenance and operating costs, increased output. Used individually, Robo-Wrap and Robo-Lift can be integrated with your existing equipment. Write for full details. Address Department A.

LYNCH ROBO
CORPORATION
A Division of
LYNCH CORPORATION
Anderson, Indiana

FEDERAL TOOL ROBO-WRAPS PLASTIC ITEMS OF VARIOUS SIZES, SHAPES

Circle 680 on Inquiry Card

thrown back on the feeder table. Production rate is approximately 300 per hour. **W. E. Dunn Mfg. Co.**, 306 W. 24th St., Holland, Mich.
—*Circle 413



Packeting Machine

Item 414

Unit automatically feeds, counts, wraps, seals and codes in a single station operation. Machine has a production rate of 100 heat-sealed packets per minute, each imprinted with up to three lines of identification.

Equipment is available with various packeting heads. Vibracount head with a vertical vibratory hopper is designed to eliminate damage to fine finishes. Delta head is a universal counting and feeding mechanism for irregularly shaped hardware items, for high-count runs or for short runs of different items. Turret head is available for individual packeting of large hardware items not suitable to orientation. Semi-automatic Vibracount, which can be a separate unit, is designed for feeding and counting hardware items into preformed packages, containers, or for delivery to conveyors and other equipment in automated production lines. An electric eye accessory can be obtained to control front and back registration when preprinted packeting material is used. **Brown Filling Machine Co.**, Fitchburg, Mass.
—*Circle 414

Television Camera

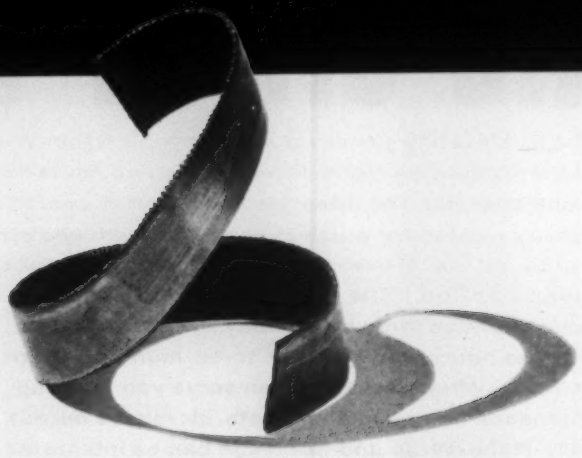
Item 415

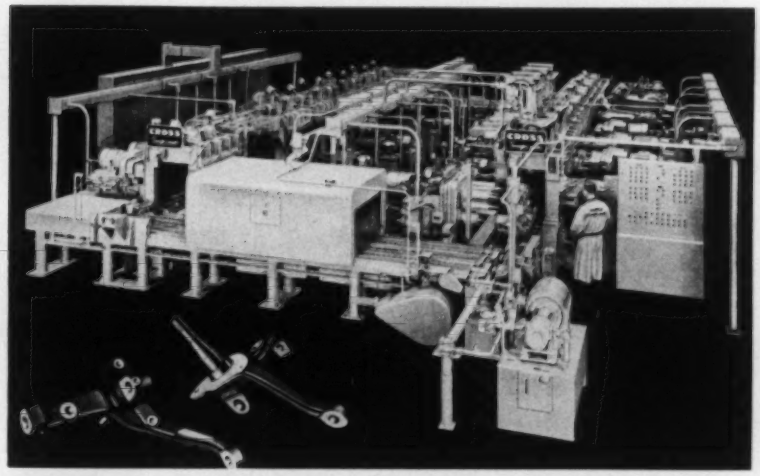
Capable of bright, clear pictures with light levels as low as 10 or 15 ft-c. Model TC-100 is completely self-contained, requires no external power supply and is available with three lens turret.

Company also offers line of remote controls for focus, iris and turret drives; video monitors, switching units, cables and connectors. **Industrial Television Sales Dept., Allen B. DuMont Laboratories Inc.**, 760 Bloomfield Ave., Clifton, N. J.
—*Circle 415

*For Inquiry Card, see page 17

LOOK... NO HANDS!



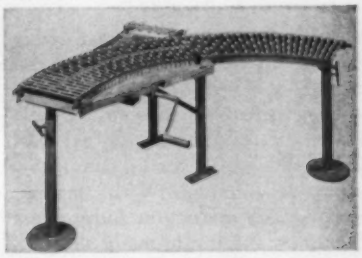


Machining Integral Wheel Spindle and Steering Arm

Item 416

Unit machines front wheel spindles and steering arms which are one piece forgings. Right and left hand spindles are processed together so that a set for one car is completed with every machine cycle.

Operations performed by the machine are: Straddle mill the upper and lower support arm bosses; straddle mill the steering arm boss; mill the steering arm stop pad; mill the spindle keyway; drill and taper ream the upper and lower support arm holes and the steering arm hole; drill, ream, chamfer and spotface the two brake mounting plate holes; drill, counterbore, spotface, chamfer and ream the brake anchor hole; drill the spindle cotter pin hole; and thread the wheel spindle. The wheel bearing diameters are turned and ground in pre-conditioning operations for the unit. Parts are carried by pallet-type work holding fixtures, and transferred through the 17 stations. A pushbutton operated power wrench clamps and unclamps the parts in the pallet fixtures. **Cross Co.**, 17801 14 Mile Rd., Detroit, Mich.
—*Circle 416



Conveyor Switch

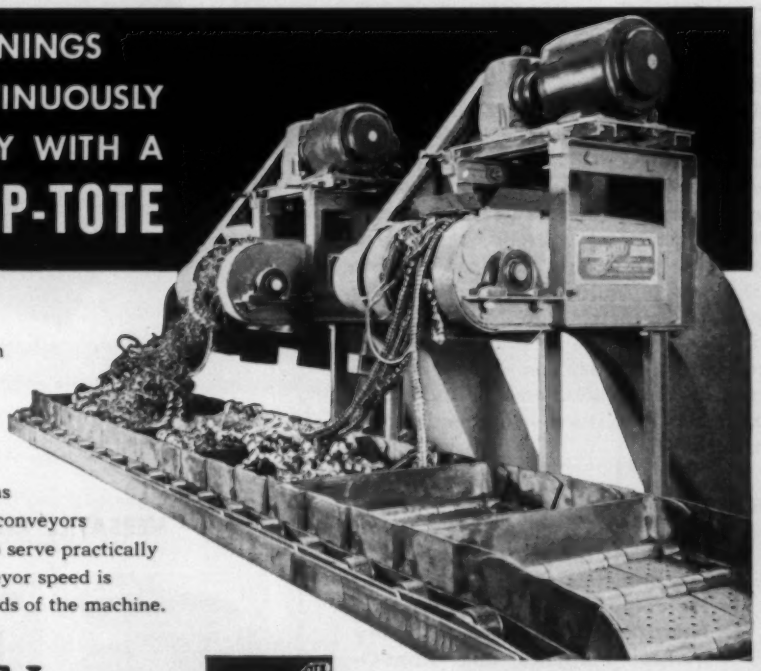
Item 417

Designed for use with company's conveyor, Flex-a-switch is

*For Inquiry Card, see page 17

REMOVE CHIPS, TURNINGS AND BORINGS CONTINUOUSLY AND AUTOMATICALLY WITH A

MAY-FRAN CHIP-TOTE



That's right! The May-Fran CHIP-TOTE permits the continuous operation of machine tools by eliminating down-time for scrap removal . . . skilled workers stay on the job . . . production increases by as much as 20%! Versatile CHIP-TOTE conveyors are available in a wide range of sizes to serve practically any type or size of machine tool. Conveyor speed is adjusted to meet the scrap removal needs of the machine.

MAY-FRAN ENGINEERING, INC.
1761 Clarkstone Rd. • Cleveland 12, Ohio

Write today for your copy of Bulletin MF-640.

7721-MF

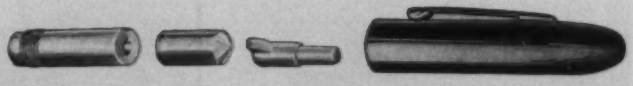
Know these FERGUSON-BUILT

when it's time to decide 'ROTARY OR IN-LINE --BUILD OR BUY'

Since many common denominators of automatic machinery requirements can be served by common solutions, Ferguson, with a greatly diversified knowledge of automatic production processes, can be of invaluable assistance in your progress toward automation. With experience in many mass production industries, we are bound by the traditions of none. Methods we developed to assemble roller skate wheels are applied to assemble ball point pen tops; special purpose developments in assembling automative components are useful to us in designing machines for the electrical industry and ideas pertaining to the assembly of small motors are adaptable to assembling appliance components. *In short, we offer creative engineering based upon proved methods and principles.*

Both of the machines illustrated here were designed and built by Ferguson, using standard Ferguson transfer bases . . . cataloged items available in various sizes and with different increments of movement and work time. Usage of such equipment not only reduces delivery time and engineering charges but also provides a base of known capability demonstrated by outstanding performance in scores of applications. As manufacturers of both in-line and rotary transfer machines, we have only one criterion in the selection of a base for any particular installation — the requirements of the job.

If it's time for you to decide, "Rotary or In-line — Build or buy", send for Ferguson Catalogs describing Intermittor index tables and rotary transfer machines and Trans-O-Mator in-line machine bases. You'll find them very helpful in your planning for conversion to automatic assembly.

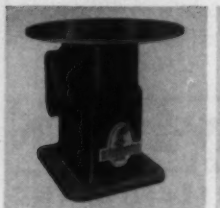


HOW RITEPOINT PENCIL COMPANY ASSEMBLES PLASTIC BALL POINT PEN TOPS . . .

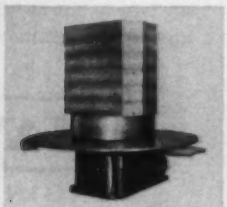
A standard 12-stop Ferguson Intermittor with a 36" dial
is tooled to punch two holes in plastic top;
insert and fasten the clip;
add the pushbutton and a spacer;
insert and cement a threaded bushing and eject
the finished assembly at the rate of 20 per minute.
One operator feeds the top and clip;
all other operations are automatic.
All tooling is air actuated and designed and built
by Ferguson, using standard components wherever possible.

VERSATILE ROTARY MACHINE BASES

with tooling plates

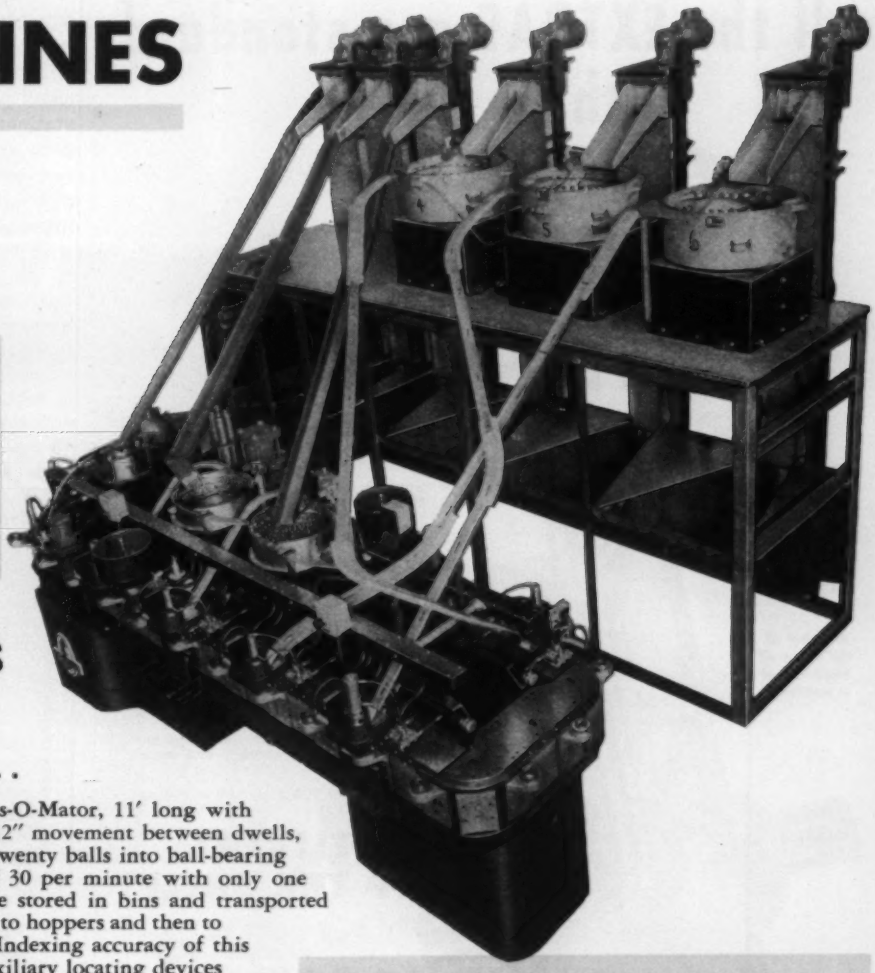


basic machine



with center column

MACHINES



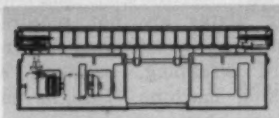
HOW BALL-BEARING ROLLER SKATE WHEELS ARE ASSEMBLED AUTOMATICALLY.....

A standard Ferguson Trans-O-Mator, 11′ long with product carriers having a 12″ movement between dwells, assembles eight parts and twenty balls into ball-bearing skate wheels at the rate of 30 per minute with only one observer-operator. Parts are stored in bins and transported by magnetic belt conveyors to hoppers and then to the various work stations. Indexing accuracy of this machine is such that no auxiliary locating devices are required.

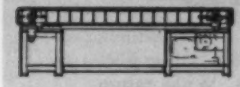
Fifteen stations are used to assemble the parts. Each is provided with a safety mechanism to guard against damage to the installation in the event of a jam. Standardized placing mechanisms were used in several instances as well as other standard components.

Write for more information about these and other installations and full details on standard Ferguson in-line and rotary transfer machine bases.

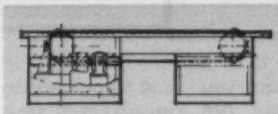
FOUR STANDARD IN-LINE MACHINE BASES IN VARIOUS SIZES



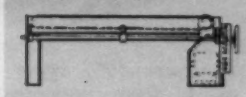
Type A-Heavy Duty



Type AE-"Economy" Model



Type B - Over-and-Under



Type C - High Speeds

SEND FOR THESE CATALOGS:

Catalog 301 — Index Tables and Rotary Transfer Machines

Bulletin 401 — Standard In-Line Machine Bases

Bulletin 500 — Ferguson Tooling Design Facilities

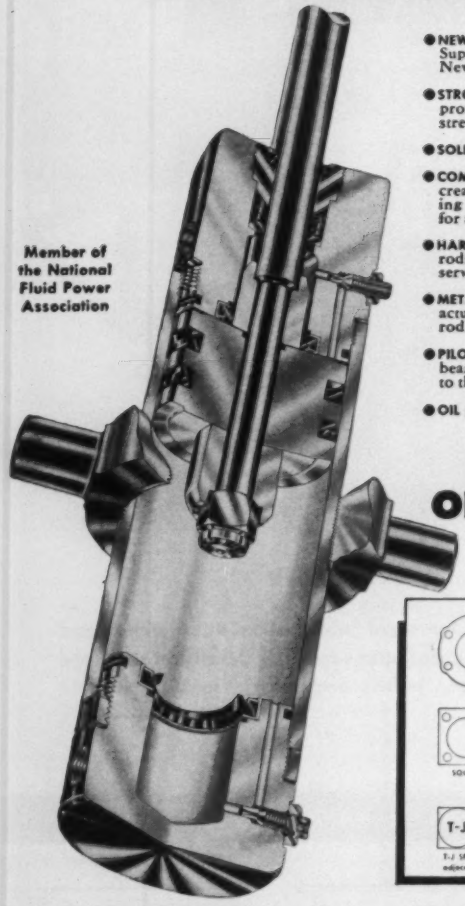
FERGUSON MACHINE CORPORATION

OF INDIANA

P. O. BOX 5841 ST. LOUIS 21, MISSOURI

all the EXTRAS are standard with

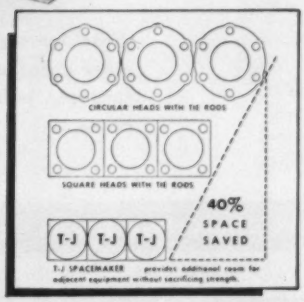
T-J Spacemaker CYLINDERS



Member of the National Fluid Power Association

- **NEW** *exclusive* ingenious cushion designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Cushion for Oil.
- **STRONGER** than outmoded tie rod design, proven through actual tests. No tie rods to stretch.
- **SOLID STEEL HEADS** throughout the full line.
- **COMPACT DESIGN** eliminates tie rods, increasing the strength and reducing mounting space required, providing extra room for adjacent equipment.
- **HARD CHROME PLATED** body bores and piston rods . . . assure you of long trouble-free service. (Standard at no extra cost.)
- **METALLIC ROD SCRAPER,** not just a wiper, actually removes foreign matter from the rod.
- **PILOTED PACKING GLAND** with extra long bearing. Additional strength and support to the piston rod.
- **OIL** pressure to 750 p.s.i. AIR to 200 p.s.i.

DELIVERY OFF THE SHELF!

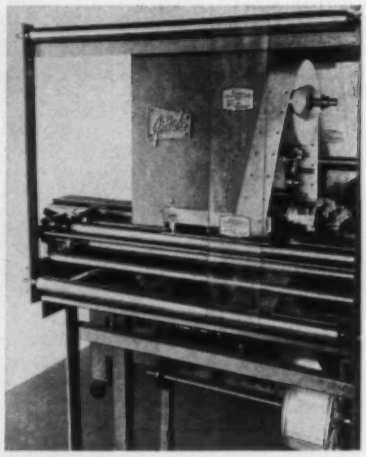


You *save 40% space* when you switch from outmoded tie rod cylinders to the T-J Spacemaker! It's stronger, too! Fits right into automation programs in countless plants. Delivers top performance and dependability with a big *plus* in advanced features. Wide range of styles, capacities . . . reduces man-hours and costs in all kinds of push-pull-lift jobs. Off-shelf delivery in 64,000 combinations!

NEW LITERATURE—Send today for new Catalog SM56 with complete engineering details on Spacemaker line. Write The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON
RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

suitable in combinations with curves and straight sections to distribute work in production, feed small parts assembly or inspection stations; gather and assemble orders and distribute finished work for stockpiling. For production line operation, conveyors can be installed directly on work benches with two mounting brackets per 5 ft section screwed to the bench top. Sections are placed on the brackets so they engage the conforming cross members of the conveyor section. Unit is available in wheel or roller type for quick adjustment from through travel to 45 degrees, right or left. **Metzgar Conveyor Co.,** 408 Douglas St. N. W., Grand Rapids 4, Mich. —*Circle 417



Printing/Packaging Unit

Item 418

Machine prints multicolor designs on cellophane, plastic film or paper packages during the packaging operation. Ink or printing plates are not required and unit can be attached to any standard wrapping, bundling or bagmaking machine. Designs can be of any shape or size up to 4 by 3 inches and can include up to 4 different colors.

Process provides for all colors to be laid down simultaneously in a simple direct-transfer action and allows placing of prints on either the face or underside of the packaging material. Designed to apply Dennison Mfg. Co.'s Ther-

*For Inquiry Card, see page 17

Why **DYNALOG*** *design is out front of all electronic potentiometers . . .*

IT GIVES STEPLESS, CONTINUOUS BALANCING!

Advance features to improve control of temperature, pressure, flow . . .

1. No periodic maintenance
2. No dry cell—no standardizing
3. No high-speed moving parts
4. No slidewire or galvanometer
5. *Stepless,* continuous balancing
6. Adaptable to narrow spans

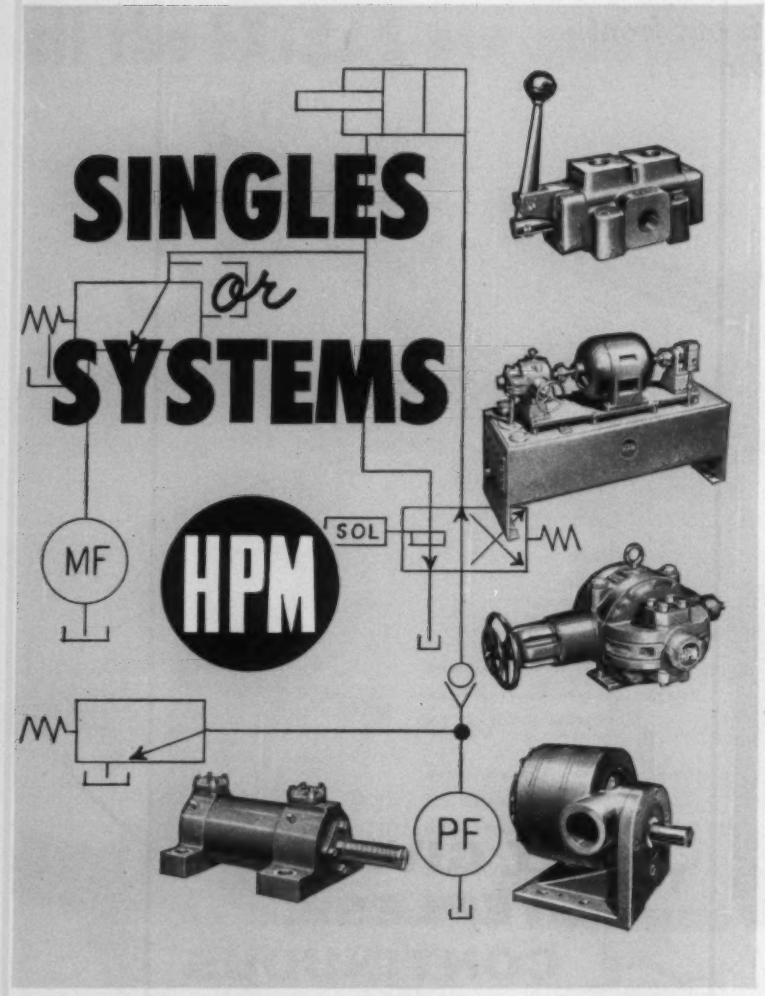
FOXBORO
REG. U.S. PAT. OFF.
DYNALOG
ELECTRONIC INSTRUMENTS

Here's precision in motion . . . the smooth, continuous balancing action of a Dynalog Electronic Instrument! No slidewire with faltering step-by-step inaccuracies . . . no sliding or rubbing contacts. Instead, a simple, variable, radio-type capacitor and positive magnetic drive. It's friction-free, wear-free.

That's why Dynalogs respond almost instantly to the slightest change in a process variable, with a sensitivity of 1/100 of 1% of scale . . . accuracy of ¼ of 1% of scale. It's also the reason they're the maintenance man's dream. About all he does is supply ink and charts!

Dynalogs are used with any primary element—resistance, voltage, capacity, inductive. They perform with effortless accuracy, even on control and recording problems that conventional balancing-type instruments can't handle. For the complete story, write for Bulletin 20-10. **The Foxboro Company, 1210 Norfolk Street, Foxboro, Mass., U.S.A.**

*Reg. U. S. Pat. Off.



WHAT'S YOUR HYDRAULIC PROBLEM?

H-P-M's complete line of hydraulic components, PLUS a 77-year background of experience in the design and building of hydraulic equipment, can solve your hydraulic problems . . . whether it's a single item or a system. And you can transfer your worries for the job to one responsible supplier. The power and control of power needed, to get the motion you require, are designed to your specifications.

Plan hydraulically — get in touch with an H-P-M Engineer today. A complete line of standard hydraulic pumps, power units, valves, cylinders and accessories makes the job of selecting the right hydraulic component simpler, easier and at a savings. Ask for Bulletin 1101 today — a complete condensed catalog of H-P-M hydraulic equipment.

HPM

HYDRAULIC POWER DIVISION

THE HYDRAULIC PRESS MFG. CO.

Mount Gilead, Ohio, U.S.A.

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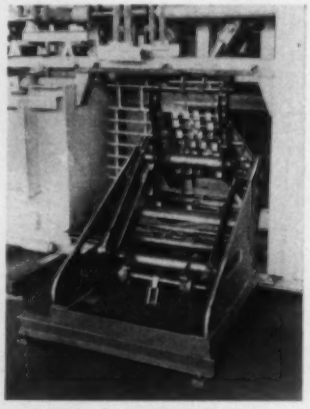
1877—1957

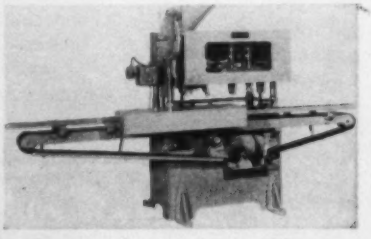
image transfers, Imagraph machine produces up to 100 impressions per minute and can be adjustable for accurate positioning of a design at any desired location on the wrap. **Adolph Gottscho Inc.,** Hillside 5, N. J.
—*Circle 418



Plating Unloader

Item 419

Device automatically unloads plated parts from company's plating machine. Unloader grasps and removes a rack-load of parts as they come from the plater's drying station, tilts the load forward to deposit plated parts onto a moving conveyor belt. Rack then returns to the machine for the trip to the loading station via the stripping and rinse baths. Unit can be synchronized with any preset cycle of the automatic plater. **Wagner Bros. Inc.,** 400 Midland Ave., Detroit, Mich.
—*Circle 419



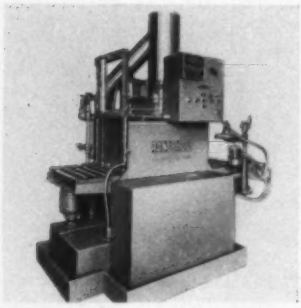
Automatic Sealing Unit

Item 420

Machine automatically seals containers from pints up to gallons

*For Inquiry Card, see page 17

on-center-hole type cans and up to quarts on off-center type cans at speeds up to sixty per minute. Containers automatically go into the sealer direct from the filling machine. Hopper is manually loaded with lids, adjustments to suit the can being run are made and the sealing operation begins. Unit is equipped with two ½ hp motors. Conveyor height is 33 inches minimum. **Resina Automatic Machinery Co. Inc.**, 572 Smith St., Brooklyn 31, N. Y.
—*Circle 420



Inter-Process Cleaner

Item 421

Single stage inter-process washer was designed by engineers of a leading auto manufacturer and built for them in a lot of ten. The result of these combined efforts is a compact cleaning machine which fills specific requirements. Each of the ten washers is installed between machining operations in a plant producing automatic transmissions.

Job performed by each of these washers is the removal of chips and cutting oils from machined parts in order to assure accuracy of succeeding machining operations. Parts in transit from one machining operation to the next are washed in this machine.

In operation, parts on the roller conveyor, on fixtures or in baskets are loaded into the cabinet. Vertically sliding air-operated doors at both ends of cabinet are closed by manual operation of control valve lever located at loading end. When doors are closed, pump is started and parts are subjected to spray action cleaning with a heated, recirculated washing solu-

*For Inquiry Card, see page 17

Circle 687 on Inquiry Card→

HOW CAN AUTOMATIC MATERIAL HANDLING REDUCE *Your* DIRECT COSTS?

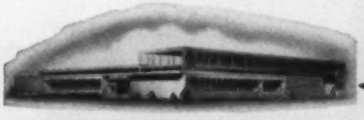
A "Wilson" Project Analysis will outline the most effective application of cost-saving equipment

Automation is often regarded only in terms of costly, complicated equipment. Properly defined and applied, automatic handling equipment can be a relatively simple, inexpensive means to reduce direct labor and move parts more conveniently.

A "Wilson" Project Analysis will outline the most effective application of cost-saving automatic handling for you—whether it be a single operation, a department, or an entire plant.

It is a complete recommendation tailored to your needs and normally includes detailed mechanical layouts, cost analysis, an estimate of total equipment investment, cost of plant rearrangement, expected amortization period, etc.

For more information, fill in and mail the reader service card bound into this issue. We will also reserve in your name an advance copy of "Automating for Profit," a fact-filled 24-page booklet telling "when to automate and where," now in preparation.



WILSON AUTOMATION

27101 GROESBECK HIGHWAY at E. ELEVEN MILE • WRITE C/O P. O. BOX 3855, DETROIT 5, MICH.

Designers and builders of automatic equipment for handling, loading, conveying, assembling, storing, packaging, testing—for parts in process.

SELECT-O-PUSH SAVES SPACE WITHOUT SACRIFICING FUNCTION!

One unit, the Westinghouse Select-O-Push, combines a pushbutton and selector switch to do the job normally requiring two assemblies. It cuts panel-front space need by half.

When wired with a standard double-pole contact it becomes versatile in limited space, freeing valuable enclosure area.

The same attention to detail built into all Westinghouse controls applies to the Select-O-Push. It functions excellently where moisture threatens. Tight-fitting gaskets, stainless steel shafts, precision milling—all help keep out harmful liquids.

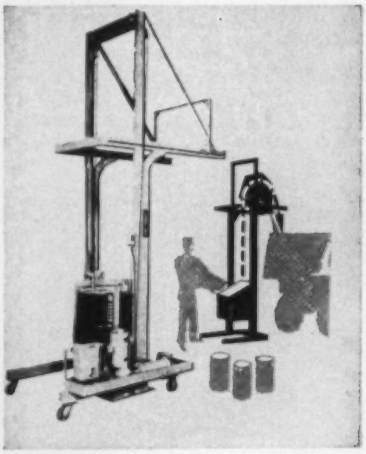
A Guide to Control (B-7022) will tell you more about Oil-Tite* controls. The new 72-page *Push-button Guide* (B-6749) will give you information on the complete line. Write to Westinghouse, Box 868, Pittsburgh 30, Pa. *Trade-Mark J-30254

YOU CAN BE SURE...IF IT'S

Westinghouse

tion. After the washing period, doors are opened, which automatically cuts off the spray. Then, parts are removed at the unloading end and next parts to be cleaned are loaded and cycle is repeated. **Ransohoff, Inc.**, North Fifth and Ford Blvd., Hamilton, Ohio.

—*Circle 421



Loading-Dumping Unit

Item 422

Device is capable of handling various types of containers, including drums, barrels, bags, boxes, and trucks.

Model 54 is designed for loads up to 750 lb with a rear loading and front discharge operation. Automatic cycling control of machine can be supplied. Also available is Model 36 for front dumping of loads over 750 lb and Model 32 for side dumping of loads from 2000 lb up. **Langley Mfg. Co.**, 9206 Cambridge St., Cambridge 41, Mass.

—*Circle 422

Heating Unit

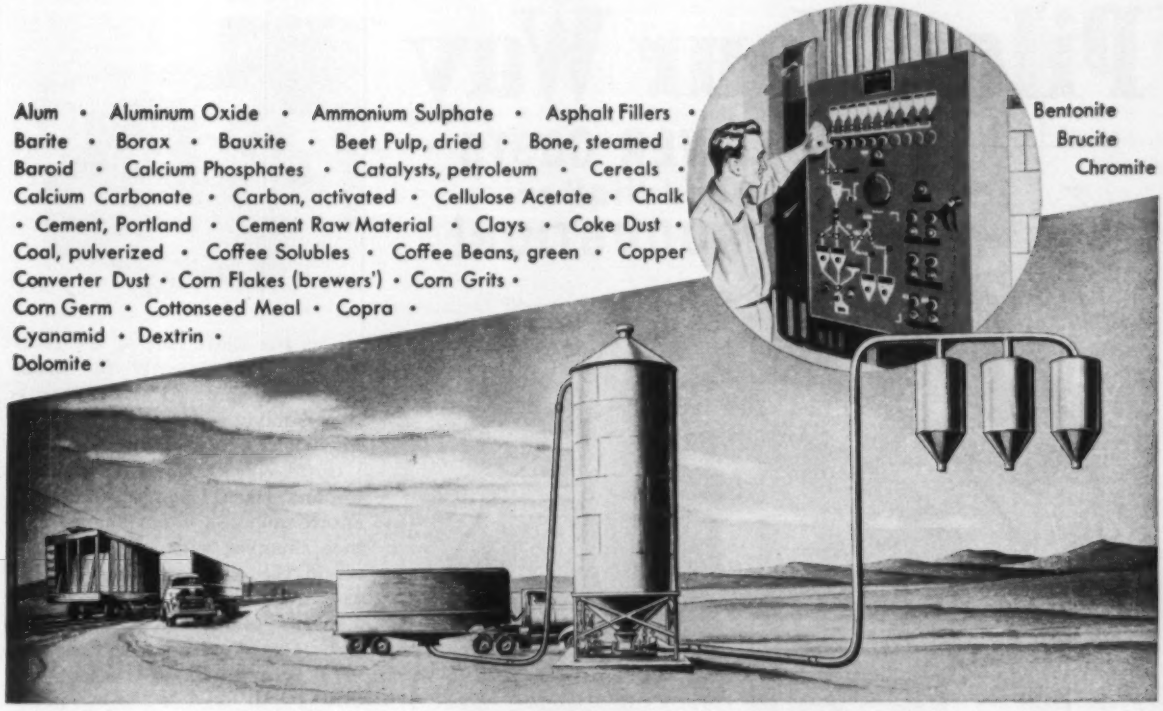
Item 423

Machine is adaptable for debonding and blueing of rotors used in electric motors. Unit heats the periphery of the rotor to approximately 900F, separates the die-cast aluminum from the steel laminations and increases operating efficiency of the motor. Heating also blues the steel laminations and

*For Inquiry Card, see page 17

Alum • Aluminum Oxide • Ammonium Sulphate • Asphalt Fillers • Barite • Borax • Bauxite • Beet Pulp, dried • Bone, steamed • Baroid • Calcium Phosphates • Catalysts, petroleum • Cereals • Calcium Carbonate • Carbon, activated • Cellulose Acetate • Chalk • Cement, Portland • Cement Raw Material • Clays • Coke Dust • Coal, pulverized • Coffee Solubles • Coffee Beans, green • Copper Converter Dust • Corn Flakes (brewers') • Corn Grits • Corn Germ • Cottonseed Meal • Copra • Cyanamid • Dextrin • Dolomite •

Bentonite
Brucite
Chromite



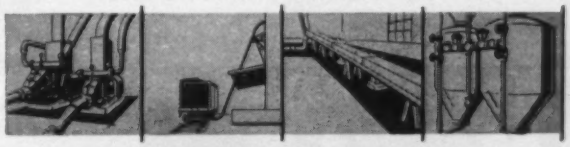
Diatomaceous Earth • Feed Ingredients • Feeds, soft • Feldspar • Fertilizers • Flaxseed • Flue Dusts • Fluorspar Flour • Fly Ash • Fuller's Earth • Gluten Meal • Gypsum (raw or calcined) • Grains • Ilmenite • Iron Salts • Litharge Lime, pebble • Lime, hydrated • Limestone, pulverized • Magnesite • Magnesium Oxide • Manganese Dioxide • Milk, dried • Nylon Pellets • Phosphate Rock, pulverized • Polyethylene • Pyrites • Quartz, pulverized • Rubber Pellets • Resins, synthetic • Salt Cake • Shells, pulverized • Semolina • Talc • Wood Chips • Wood Flour • Zinc Oxide

CONVEY MANY DRY BULK MATERIALS BY AIR

Automatically

Conveying of dry bulk materials can be accomplished automatically—by air—with Fuller systems. Dollar losses, formerly conceded to be "natural" incidents of conveying, are now being chalked up as new savings. Fuller systems are designed for minimum maintenance . . . completely enclosed for sanitary transportation from carrier to storage to process without spillage. Installation is possible anywhere pipelines can be run without changing plant structures or interrupting production.

If you use dry bulk materials, investigate the possibilities of profiting with Fuller. Write for Bulletin G-2, "How to Pull Dollars Out of Thin Air."



Fuller
pioneers in harnessing AIR

FULLER COMPANY
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SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION
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G-139
3676

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to LOWER COSTS and Higher PRODUCTION!

POWER SCREW DRIVERS
An extensive, versatile line in both bench and pedestal type.

Avoid the Reefs of Production Bottlenecks!

Use **DPS** **PARTS FEEDERS and ASSEMBLY MACHINES**

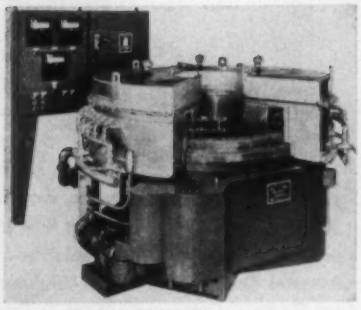
- **The advantages are too great to overlook: Speed never before equalled . . . Economy . . . Greater Accuracy . . . and Stepped-up Profits. Write for catalog now . . . Tell us your problem . . . Send parts or assembly and our Engineering Department will make recommendations.**

BOWL FEEDER
Electrical vibratory type to feed parts that cannot be tumbled.

BARREL FEEDER
with stationary ring cover for heavy-duty production.

DETROIT POWER SCREWDRIVER CO.

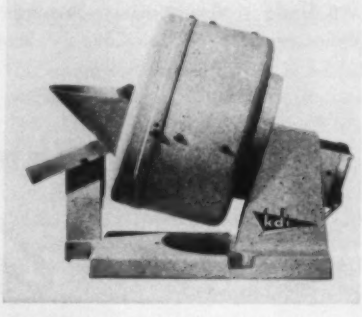
2811 W. FORT STREET • DETROIT 16, MICHIGAN



causes the shaft hole of the rotor to expand sufficiently for insertion of the shaft. Heating time is 3 to 4 minutes for a 4-inch diameter rotor.

Outfit consists of a rotating refractory hearth ring with rotating fixture spindles, donut shaped furnace chamber with multiple burners in the outer periphery. Furnace chamber has two zone temperature controls and limit control. **Gas Appliance Service Inc.**, 1940 Balmoral Ave., Chicago 40, Ill.

—*Circle 423



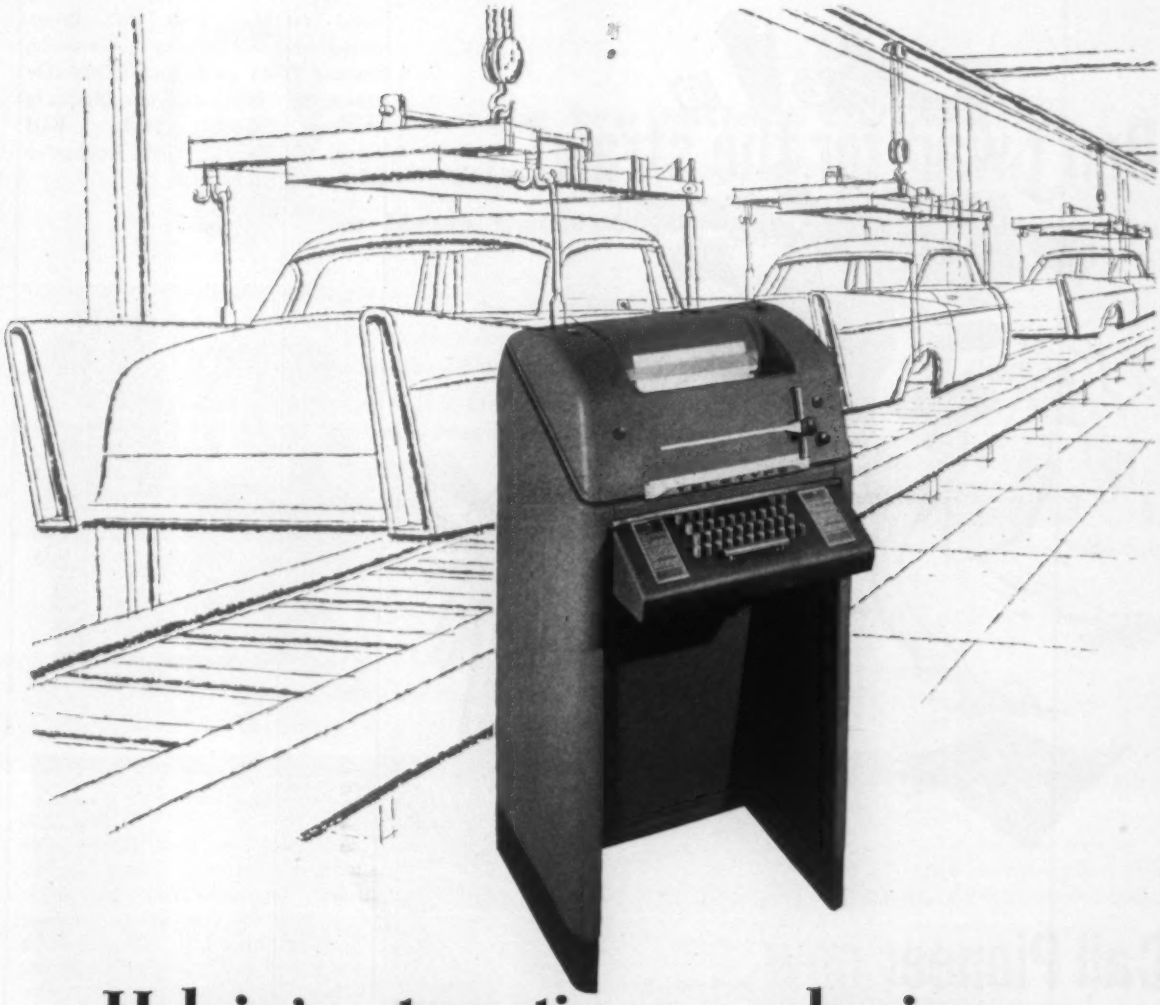
Drum Hopper

Item 424

Machine is designed for the high-rate orienting and feeding of small metal and plastic parts. Model 110 can be tooled to feed headed fasteners, nuts, rivets, wire terminals, light electrical components, and other small metal and plastic parts at rates up to 150 pieces per minute.

Mounting plate is a cast aluminum base which supports the 10-inch diameter steel drum. Drum is mounted on a double row ball-bearing drive shaft and is driven through enclosed spur gears by a high torque Barber Colman gear

*For Inquiry Card, see page 17



Helping automation serve business and industry

The new world of automation has made Teletype page printers and perforated tape equipment more important to business and industry than ever before.

Here, for instance, are some of the ways Teletype equipment is working daily in the field of automation: coordinating assembly line operations . . . serving computers with data transmission . . . providing punched tape for controlling machinery . . . processing customer orders from start to finish with little manual effort.

If you would like a copy of our booklet, "The ABC's of Teletype Equipment," write to Teletype Corporation, Dept. AU10, 4100 Fullerton Avenue, Chicago 39, Illinois

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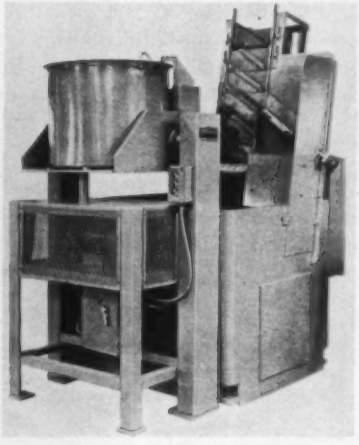
INDUSTRIAL ENGINEERS, CONSULTANTS & DESIGNERS
BRANCH OFFICES IN DAYTON, OHIO, WASHINGTON, D. C. and TORONTO, ONT., CAN.

Circle 692 on Inquiry Card

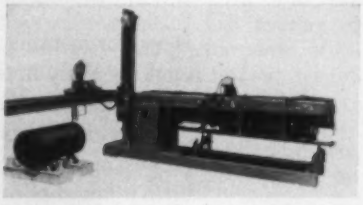
head motor. Unit has interchangeable pick-up buckets, formed front pan, and adjustable mounting brackets to facilitate chuting different parts. **KDI Corp,.** 950 Exchange St., Rochester 8, N. Y.
—*Circle 424



Elevating Feeder

Item 425

Adaptable to feed rolling and sliding parts at preset speed, feeder provides full automatic parts flow from a barrel conveyor line into machines. Model 2500 handles piston pins in conveyor barrels, feeds them properly oriented at any desired constant speed. Unit is powered by a ½ hp, 3-phase, 220/440v motor with variable speed drive and electric brake. **Feedall Inc.,** 38399 Pelton Rd., Willoughby, Ohio.
—*Circle 425



Welding Unit

Item 426

Device welds metal cylinders and tanks of all kinds. Automatic welding head is mounted on a carriage and longitudinal seams are

For Inquiry Card, see page 17

A raw egg travelled through this piston-manufacturing z-line without breaking

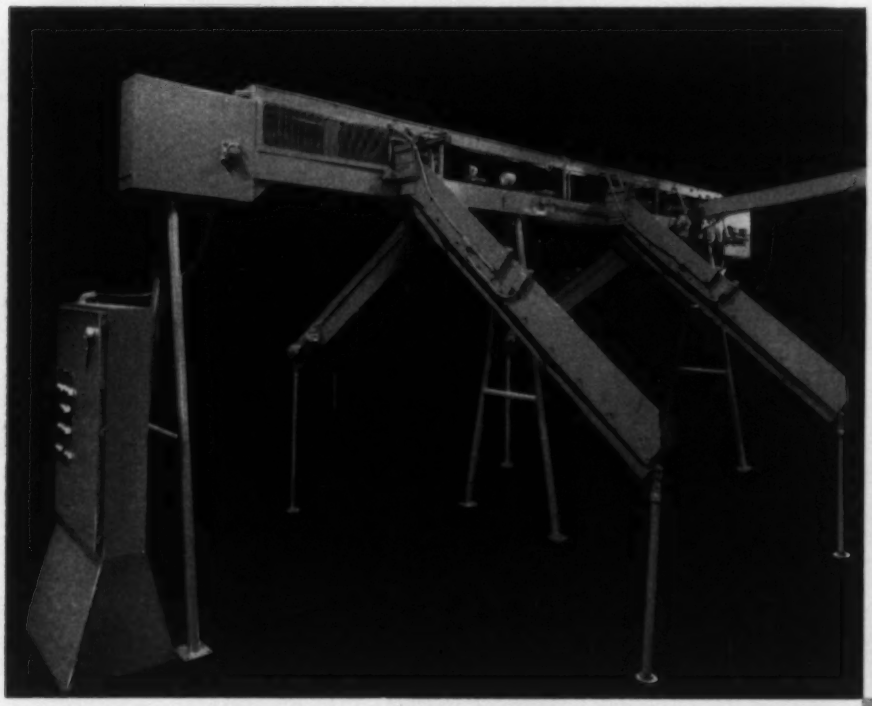
That defines the gentle handling which can be had in the integrated, completely automatic manufacturing system called the Z-Line. Yet it is only one feature – and optional.

There are Z-Lines in production which automatically produce an entire "family" of parts, *with no modification.*

The Z-Line is built to your needs from standardized components. It makes use of conventional machine tools (perhaps they are already in your plant). Maximum machine utilization is inescapable because each machine is fed on its individual demand.

The Z-Line cuts costs, tangibly and impressively.

May we discuss this with you?



This overhead distribution machine, a unit of a Z-LINE, carries two different pistons to four grinders. Each grinder receives on its own individual demand. Pistons never touch each other. Production rate is 900 per hour, 450 on each side.

Established in 1949

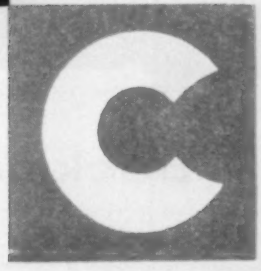
CARGILL • DETROIT *Corporation*

Designers and Builders of Automatic Manufacturing

2254 Cole Avenue • Birmingham, Michigan

MEASUREMENT AUTOMATION DIVISION

Gages, size controls, and components.



Circle 693 on Inquiry Card

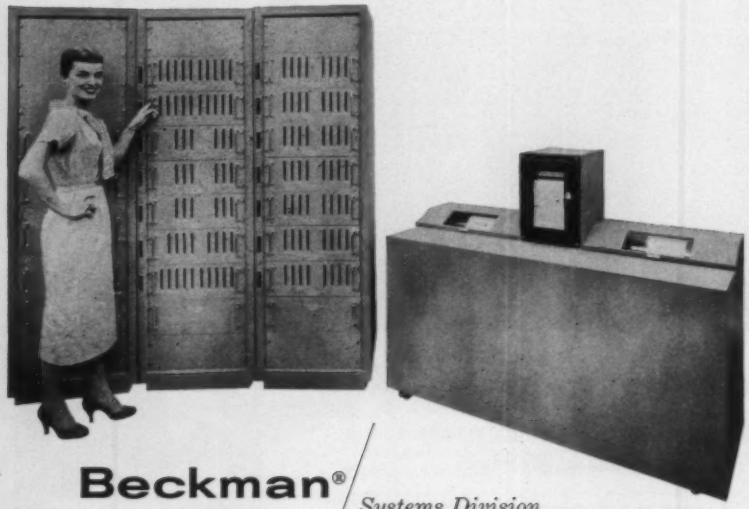
Magnetic-Core Coil Classifier Inspects Tin Plate Continuously, Automatically

Beckman coil classifiers are measuring and recording characteristics and defects of tin plate around-the-clock, in continuous on-line operation. Linear travel, pinhole footage, over- and under-gage tolerances, coatings, quenching strain, slivers, abrasions, damaged edges are all detected and recorded while coils are rolling and shears flying.

Data from detectors is supplemented by manual entries showing date, purchase order, coil, line, and turn numbers. All information is then delayed for correct relationship to shear position. Upon shear activation, the appropriate totalized data is recorded on preprinted formats, with separate records for quality control and customer information. This in-process correlation of upstream detection with shear control and data printout permits accurate profiling of product with no lag in production – increases profit margins.

No vacuum tubes are used – all electronic circuitry consists of extremely reliable, toroidal magnetic cores and other passive elements. Without modification, Beckman coil classifiers are compatible with data reduction systems and in-process control.

Coil classifiers are typical of the many reliable system applications of Beckman counters and timers, proved in thousands of field installations. For more information on counting and timing system applications, write for Data File D-13-48.



Beckman®

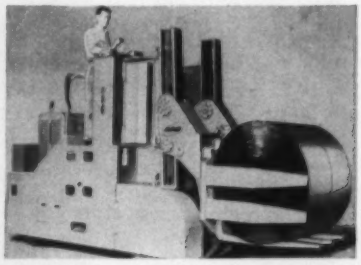
Systems Division

325 N. Muller Ave., Anaheim, Calif.

a division of Beckman Instruments, Inc.

Responsible new positions in engineering, manufacturing, technical marketing. Write for Career File 10.

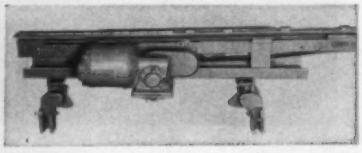
welded while the cylinder is clamped in a copper back-up, air clamped seaming fixture. Manipulating fixture is rotated to position the welding head over the cylinders mounted on variable speed turning rolls for the welding of circumferential welds. Seamer with a capacity of 12 to 36-inch I.D. up to 12 ft long has an air operated gap closing mechanism. **Pandjiris Weldment Co.**, 5151 Northrup Ave., St. Louis 10, Mo.
—*Circle 426



Coil Handling Truck

Item 427

Unit equipped with a rotating head is designed for 20,000 lb capacity. In operation, the truck picks up coils which are stored in a horizontal position, upends them during travel, and deposits the coils in a vertical position so they can be conveyed through the annealing furnace. After annealing, the truck can be used to change the position of the coils before replacing them in storage. The truck is also suitable for other handling jobs of loads up to ten tons in weight. **Elwell-Parker Electric Co.**, 4205 St. Clair Ave., Cleveland 3, Ohio.
—*Circle 427

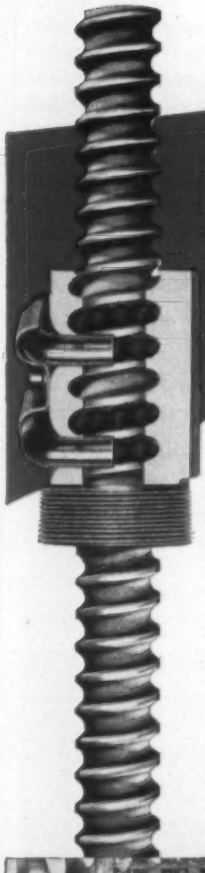


Feed Conveyor

Item 428

Suitable for centerless grinding applications, conveyor is designed to transfer cylindrical work from

*For Inquiry Card, see page 17

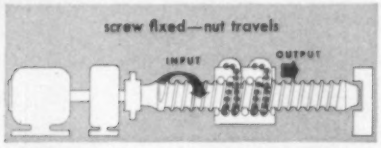


FOR MORE EFFICIENT PRODUCTION—

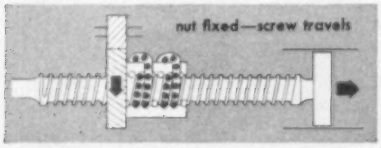
ACTUATE OR POSITION IT BETTER WITH

SAGINAW b/b SCREWS

6 decisive advantages reduce manufacturing problems and costs:



FORWARD: When rotary motion is applied to the screw, the b/b nut is driven along the axis of the screw, changing rotary motion to linear motion.



FORWARD: When rotary motion is applied to the b/b nut, the screw is driven along its longitudinal axis, changing rotary motion to linear motion.

1 **POWER SAVINGS.** Operating with over 90% efficiency, Saginaw b/b Screws permit much smaller motors with far less drain on electrical systems, and also simplify circuitry.

2 **SPACE SAVINGS.** Saginaw b/b Screws themselves are compact. They permit smaller motors and gear boxes and eliminate auxiliary equipment required by hydraulics.

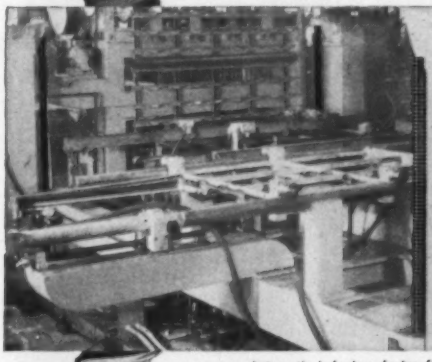
3 **DEPENDABLE PERFORMANCE.** Saginaw b/b Screws are far more reliable than hydraulics or pneumatics. Gothic-arch grooves, yoke deflectors and multiple circuits provide added assurance.

4 **PRECISE POSITIONING.** Saginaw b/b Screws will position components far more precisely than hydraulics or pneumatics; tolerances on position are held within .0006 in./ft. of travel.

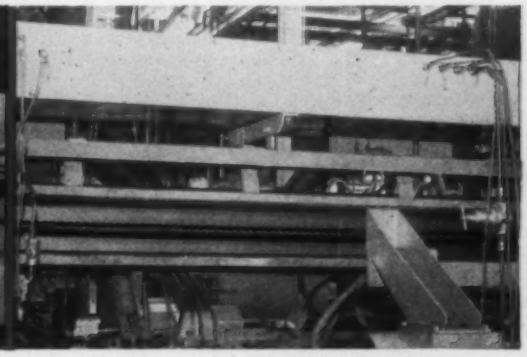
5 **TEMPERATURE TOLERANCE.** Normal operating temperature for Saginaw b/b Screws is from −75°F. to +275°F. But in selected materials, they will function efficiently at temperatures as high as +900°F.

6 **LUBRICATION.** If lubrication fails the Saginaw b/b Screw will still function with remarkable efficiency. Units have been built and qualified for operation without lubrication.

TYPICAL AUTOMATION APPLICATIONS



Automatic indexing device for stacking material. Saginaw b/b Screw used to raise and lower table.



Automatic device for loading and unloading machine. Saginaw b/b Screw used to save power and space.

If you would like further details on the use of Saginaw b/b Screws to increase the efficiency of plant operations, or specific application recommendations for your individual processes, experienced Saginaw engineers are at your service without obligation. Just write or phone us your requirements, or fill in and mail the handy coupon below.

Saginaw

ball bearing Screw

SAGINAW STEERING GEAR DIVISION OF GENERAL MOTORS • SAGINAW, MICHIGAN

WORLD'S LARGEST PRODUCER OF BALL BEARING SCREWS AND SPLINES

SEND TODAY FOR FREE 36-PAGE ENGINEERING DATA BOOK . . .

or see our section in Sweet's Product Design File

Saginaw Steering Gear Division
General Motors Corporation
b/b Screw and Spline Operation
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Please send new engineering data book on Saginaw b/b Screws and Splines to:

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COMPANY _____ TITLE _____

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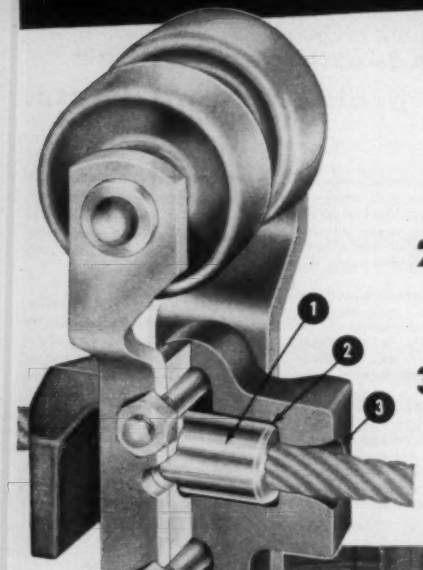
CITY _____ ZONE _____ STATE _____

Circle 695 on Inquiry Card

NOW BUSH-LOCK design The No. 1 Choice in Overhead Cable Conveyors



1. ***BUSH-LOCK®, the heart of this truly "Universal" Cable Conveyor***

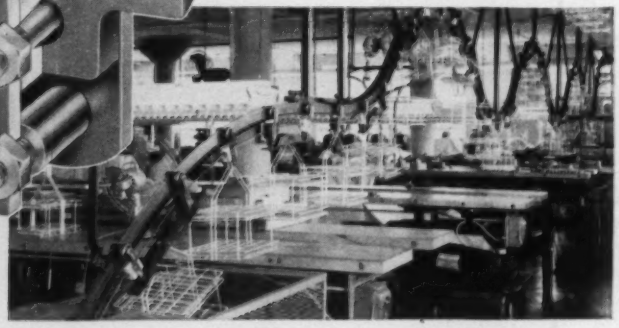
Cylindrical bushing permanently locked to preformed cable on accurate immovable centers by high-pressure swaging.

2. ***Rotary Floating Action***

Trolley castings bolted around BUSH-LOCK assure true alignment of trolley to track.

3. ***Bell shaped for longer cable life***

Castings allow cable to flex in all directions with smooth arc support.



A typical Buschman Cable Conveyor . . . carries light to medium weight loads through all operations at convenient heights.

Bush-Lock Cable in 100′ lengths provides a continuous power element with practically no points of wear. Stock track, drives, idlers and vertical curves are easily installed into a durable, efficient, low cost system.

Why not get all the facts how to produce more at less cost with compact, smoothly-operating Buschman conveyors.

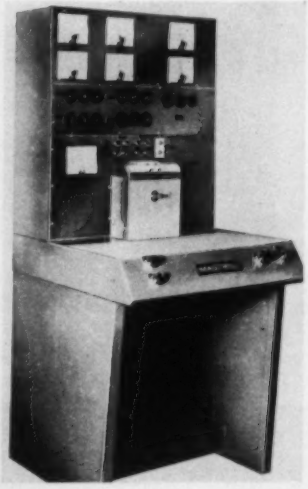
Write for literature today.

PRODUCE MORE . . . FOR LESS
Buschman
CONVEYORS

C-333-EWB

THE E. W. BUSCHMAN COMPANY
4551 Clifton Avenue, Cincinnati 32, Ohio

one production operation to another automatically. Unit consists of conveyor frame, belt, motor and transmission. Drive chain belt with ratchet-type adjustment can handle work ¼ to 3½-inch in diameter at preset speeds. Self-contained unit swings clear for easy changing of grinding wheels and is adjustable at each end for height and for length. **DePauw Industries,** 316 N. 7th St., St. Charles, Ill.
—*Circle 428



Motor Tester

Item 429

Unit checks electric motors of 1/50 hp to 1 hp capacity in three or more dynamic phases of torque, speed and current characteristics. Automatic testing is obtained by registering acceptance of minimum speed of a motor at a given torque setting. Torque setting is established by a Magtrol brake, which is capable of repeating a given torque when impressed with the same control current, regardless of speed. Acceptance or rejection is indicated on pilot lamps in front of the operator, which holds the results of a motor check until the operator has marked it for disposition. Tester is available in seven dynamometer heads, covering the range from 1 oz in. to 750 oz in. torque capacity. **Magtrol Inc.,** College & Highland Ave., Box 193, Bridge Station, Niarara Falls, N. Y.
—*Circle 429

*For Inquiry Card, see page 17

You get automatic foolproof lubrication with LUBRIVAL circulating oil system

FARVAL—
Studies in Centralized Lubrication
No. 207

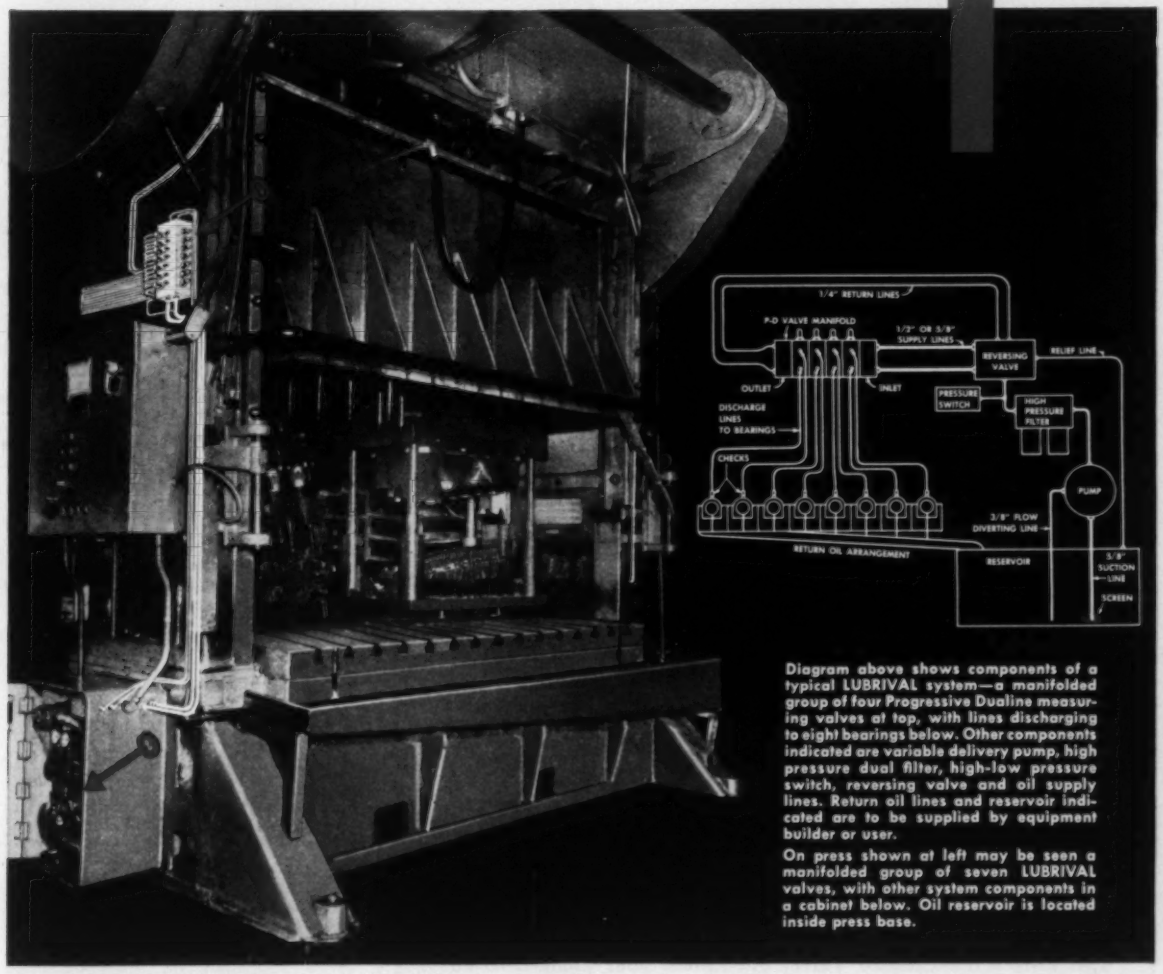


Diagram above shows components of a typical LUBRIVAL system—a manifolded group of four Progressive Dualine measuring valves at top, with lines discharging to eight bearings below. Other components indicated are variable delivery pump, high pressure dual filter, high-low pressure switch, reversing valve and oil supply lines. Return oil lines and reservoir indicated are to be supplied by equipment builder or user.

On press shown at left may be seen a manifolded group of seven LUBRIVAL valves, with other system components in a cabinet below. Oil reservoir is located inside press base.

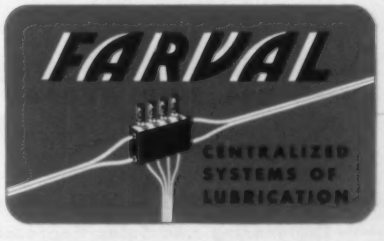
● The bearings of this 150-ton metal stamping press and others of its type are now protected by LUBRIVAL. This new Farval system for circulating oil is being installed on many varied kinds of machine tools, presses, automated machines, and other equipment calling for circulating oil lubrication.

Employing the famous Dualine principle, LUBRIVAL delivers oil to manifolded measuring valves which feed it under pressure to the bearings. Lubricant is force-fed by positive piston displacement. Flow can be regulated over a range of 10 ounces to one gallon per minute. Valves have individual sight indicators and a pressure-sensing mechanism warns of blocked or broken lines in any part of the system.

The Farval representative near you will give you all details. Or write for Bulletin 70. The Farval Corporation, 3265 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

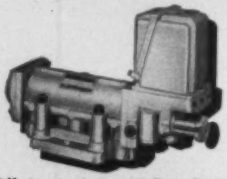
KEYS TO ADEQUATE LUBRICATION—
Wherever you see the familiar Dualine valve manifolds, dual lubricant lines and central pumping station, you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of bearings.



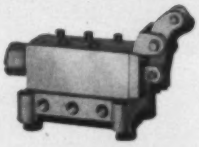
Circle 697 on Inquiry Card

Get more production—at lower cost with

Quick-As-Wink®
AIR AND HYDRAULIC
Control Valves

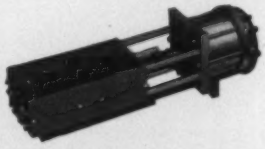


½" Single Solenoid Two Position 4-way "B"-type Valve, for Pressures up to 250 psi.



¼" 4-way Cam Operated Spring Return Valve, for Pressures up to 125 psi.

½" 2 Pedal Foot Operated 4-way Valve, for Pressures up to 200 psi.



1" Pilot Cylinder Operated 4-way Two Position Hydraulic Valve, for Pressures up to 5000 psi.

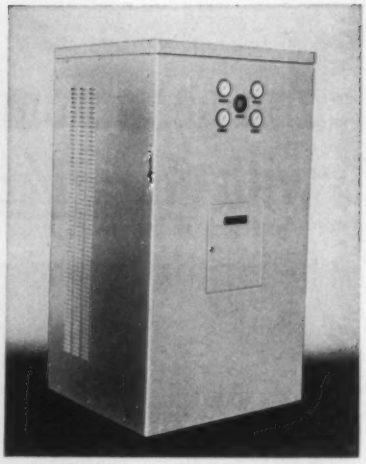
Cut your costs—and increase your production—by installing Quick-As-Wink Control Valves **throughout your plant.** Proven in service, our exclusive, patented* construction assures year after year of long, efficient, dependable **and low cost operation.** Production and maintenance men know Quick-As-Wink Valves are unsurpassed. Can you afford to gamble with less? Hundreds of different types, actions and sizes from ¼" to 4". Get full details.

*U. S. Patent No. 2,645,450

Write for BULLETIN NO. 571 Today.

Quick-As-Wink®
AIR AND HYDRAULIC
Control Valves

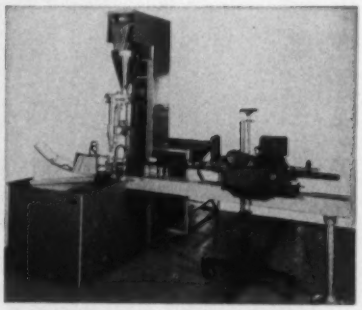
Mfd. by **C. B. HUNT & SON, INC.,** *2073 East Pershing St., Salem, Ohio*
Engineering and Sales Representatives in the Principal Cities



Heatless Dryer

Item 430

Automatic dynamic dehumidifier provides a continuous flow of superdried air or gas. Dehumidifier, called Industrol Heatless Dryer, eliminates the need for steam or electric heaters with the use of the natural properties of a desiccant. Unit is capable of delivering air or gas at effluent dewpoints of −100 F and below at line presure. Dryer is available in 18 models with chamber sizes from 2 to 30-inches in diameter. **Trinity Equipment Corp.,** Roselle Park, N. J. —*Circle 430

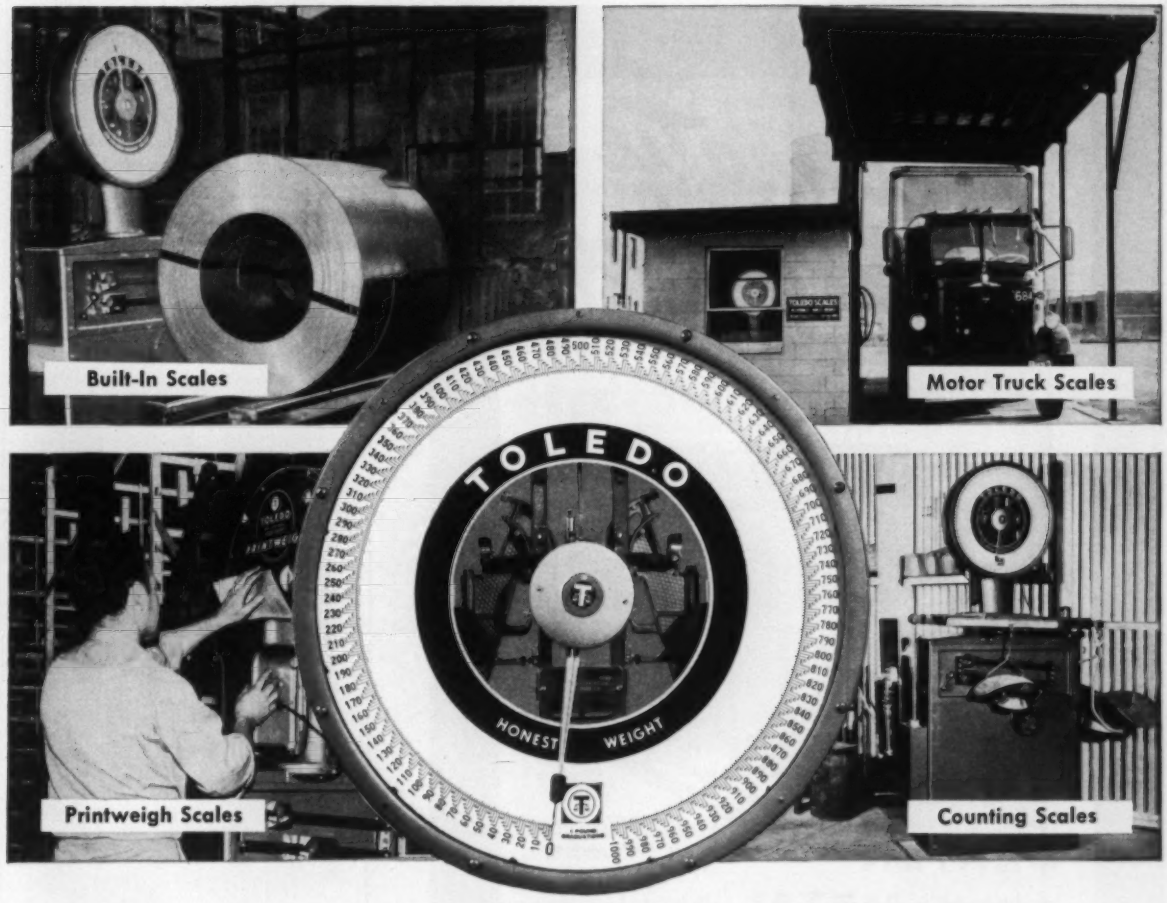


Bag Handling Unit

Item 431

Device handles bags so that they are delivered open to a filling machine. New line of units operates in conjunction with company's line of filling machines. Photo illustrates bag feeder in a typical setup with a volumetric filler and a rotary sealer. An elevator conveyor delivers material to the volumetric

*For Inquiry Card, see page 17



For new ways to control your costs . . .

take a Plant-Wide Look at Weighing!

What's the status of weighing in *your* plant? It's important to know because weighing is a vital element in the overall cost control system. Weight records directly affect costs, quality, inventory control and customer billing. Weighing errors—or inadequate weight data—set the stage for losses in output, profits and customer good-will.

This calls for integration of weighing in a plant-wide weighing system . . . the right scales in the right places . . . to supply basic records on materials received, processed, shipped or transferred.

To learn the job your scales are now doing, we invite you to send for the new Toledo Weight Fact Kit. It will help you determine how well your scales measure up as a weighing system—help you detect weighing inefficiencies that drain profits.

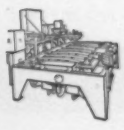
REQUEST YOUR WEIGHT FACT KIT NOW. No obligation. Address Toledo Scale Company, 1415 Telegraph Road, Toledo 13, Ohio.

TOLEDO® HEADQUARTERS FOR WEIGHING SYSTEMS

CUSTOM PRODUCTS FOR INDUSTRY

REMOTE DIGITAL WEIGHTS. Toledos automatically transmit weights to electric office machines located anywhere.

ELECTRONIC SCALES give electronic wings to weights; head may be located anywhere.

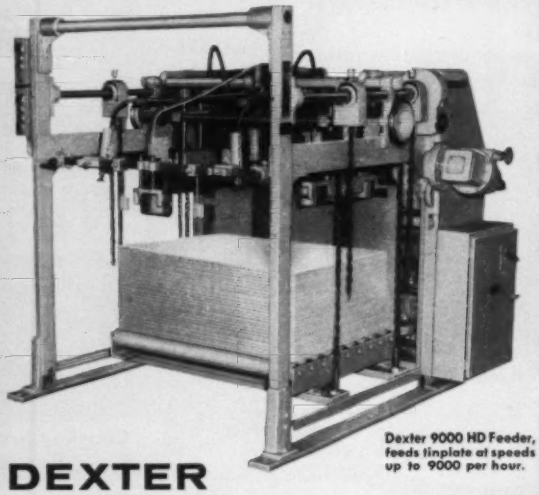


TESTING Toledos today test a wide range of parts; this device for leaf springs.

AUTOMATIC BATCHING SYSTEMS interlock batteries of scales.

Automatic Feeding

FOR SHEET METAL PROCESSING



Dexter 9000 HD Feeder, feeds tinplate at speeds up to 9000 per hour.

DEXTER

automatic **METAL** *sheet feeders*

Dexter Feeders are available in over a hundred different sizes, speeds and load capacities to suit individual requirements. Look at the wide range of the Dexter Line . . . sheet sizes from 14x14" to four by twelve feet . . . sheet thicknesses from .006 to .200 . . . load capacities from 6000 to 30,000 pounds . . . and speeds from 600 to 9000 sheets per hour! Certainly there's a model that will fit your operation, and without doubt, step up your production.

Dexter Automatic Feeders can be attached to many types of equipment . . . Metal Decorators, Coating Machines, Shears, Slitters, Punch Presses, and numerous others.

If sheet feeding is one of your production bottlenecks, give us the details. We'll be happy to tell you what we can (or can't) do for you.

Designers of sheet handling equipment for over 75 years

DEXTER **FOLDER COMPANY**

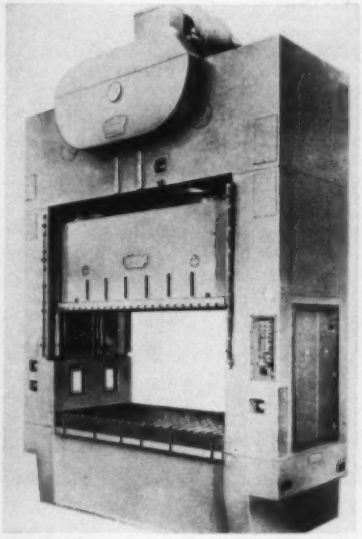
DIVISION OF MIEHLE-GOSS-DEXTER, INC.

219 East 44th Street, New York 17, New York

filler which deposits the material into the bag. The filler bag moves on a horizontal conveyor to an automatic rotary sealer. Production rate is 50 per minute.

Machines suitable for use with net-weighing, counting or conveyor types of filling equipment are also available. **Frazier & Son,** 20-01 Industrial West, Allwood-Clifton, N. J.

—*Circle 431



500-ton Press

Item 432

Suitable for producing a wide variety of automotive stampings, 500-ton four-point eccentric press has a 24-inch stroke and 15-inch adjustment. By modifying various dimensions such as stroke, slide adjustment, bed and slide areas, the unit can stamp metal of almost any thickness from light sheet to heavy plate.

Gears and drive mechanism are completely enclosed and both sides of the die area are illuminated for fast die changes. All gears are spray lubricated, and the pneumatic cushions in the bed have separate operating controls for a larger variety of press operations. Slides are air counterbalanced and a stroke indicator is included to show the position of the slide. **Cleveland Punch & Shear Works Co.,** 3917 St. Clair Ave., Cleveland 14, Ohio.

—*Circle 432

*For Inquiry Card, see page 17

Askania Regulator Company NEWS

Automatic Controls for Edge Position and Thickness, Flow, Pressure, Ratio and Combustion

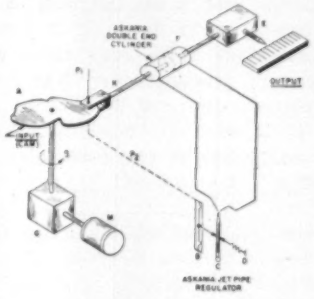
Wide Variety of Machine Tool Applications for Askania Pneumatic-Hydraulic Position Servos

Askania Regulator Company produces the largest line of industrial servos of any control manufacturer. Among these are its pneumatic-hydraulic position servos designed for linear and non-linear relationships between transmitters and receivers. Askania pneumatic-hydraulic position controls are ideally applied to production machinery.

Have These Advantages

• High Power Outputs From Low Level Input • No Mechanical Contact or Wear • No Electronics • High Speed • Low Maintenance • Easily Installed

The three systems illustrated are typical of the applications for which Askania position servos are ideally suited.

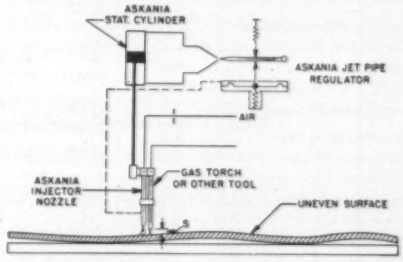


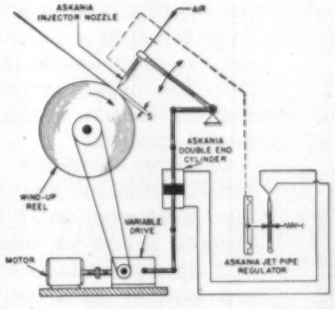
For Pattern Cutting, Multiple Tool Marking, Torch Cutting, etc.

The Askania pneumatic-hydraulic position servo shown in Figure 1 serves as a cam follower system. This type of arrangement, using a position-sensitive pneumatic sensing nozzle, a jet-pipe regulator and double end hydraulic cylinder, is readily employed for pattern cutting with a variety of tools, cutting torches, etc.

For Constant Distance Maintenance between Tool and Work Pieces

Figure 2 illustrates the use of an Askania pneumatic-hydraulic position servo with an Askania injector nozzle for maintaining the distance (S) between a tool and a moving surface. The servo maintains a cutting torch at a constant distance above a moving sheet of steel which presents an irregular surface.





Follow-Up Servo for Changing Diameter

Figure 3 illustrates another example of the use of the Askania pneumatic-hydraulic servo with injector nozzle. In this application, the distance (S) constitutes a measure of the spool diameter and the variable drive is adjusted to make speed a function of the changing diameter of the spool as it winds or unwinds. There is no physical contact with the surface which thus cannot be marred.

Write for Bulletin No. 39.2

There is an Askania pneumatic-hydraulic servo to meet your needs. Write for Bulletin No. 39.2 to Askania Regulator Company, 244 E. Ontario St., Chicago 11. Details concerning your particular problems invited.

ASKANIA REGULATOR COMPANY

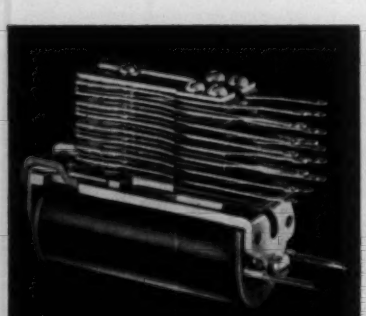
"CONTROLS FOR INDUSTRY"

HYDRAULIC, ELECTRONIC CONTROLS & SERVOS, GENERAL SYSTEMS, ENGINEERING & COMPUTER SERVICE, VALVE ACTUATORS & CYLINDERS

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

GPE

Circle 701 on Inquiry Card



Stromberg-Carlson
Telephone-Type
RELAYS

for industrial applications
PROMPT SHIPMENTS

For any part of your operation that depends on electromechanical switching, these "telephone-quality" relays by Stromberg-Carlson will provide unsurpassed reliability.

Proven by many years of meeting the exacting demands of the telephone industry, Stromberg-Carlson twin-contact relays are now available for industrial application.

These "telephone-quality" relays are available in many types, of which the following are representative:

Type A: a general-purpose relay especially adapted to the control of switching operations. Approximate size: $2^{21}/_{32}$" high, $7/_{8}$" wide with 20 Form "A" springs (maximum).

Type B: a gang-type relay—$2^{21}/_{32}$" high, $2^{7}/_{8}$" wide—which can be equipped with 60 Form "A" spring combinations (maximum). The Type BB relay accommodates up to 100 Form "A" spring combinations. Size: $2^{25}/_{32}$" high, $4^{7}/_{8}$" wide.

Type C: two relays on the same frame; mounts in the same space as the A type. It is especially effective where space is at a premium.

Type E: *interchangeable with many other makes.* It combines the time-proven characteristics of the A relay with a new universal mounting arrangement common to many other brands.

Complete specifications of all Stromberg-Carlson relays are contained in Bulletin T-5000R, available on request.

S-C
STROMBERG-CARLSON

STROMBERG-CARLSON
A DIVISION OF GENERAL DYNAMICS CORPORATION
TELECOMMUNICATION INDUSTRIAL SALES
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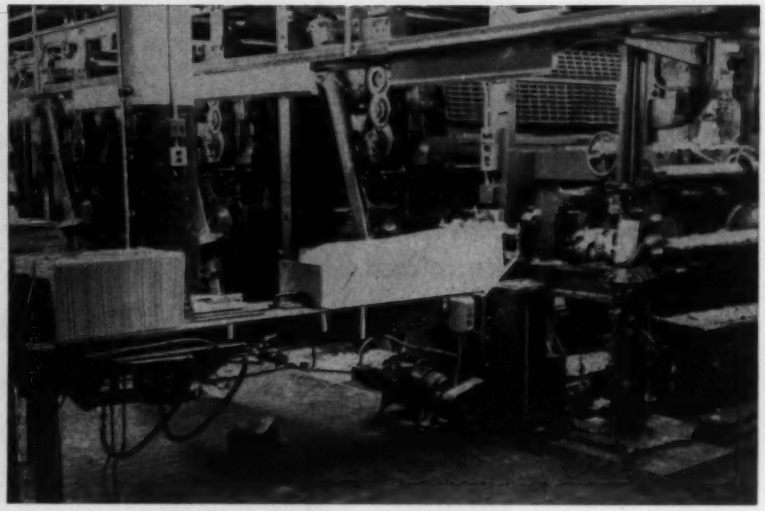
Circle 702 on Inquiry Card

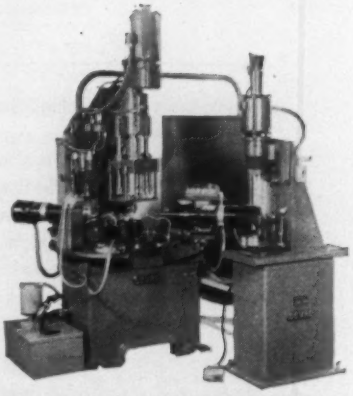


Automatic Bundling Unit

Item 433

Device bundles the product stream from a press. The product comes from the press and enters the bundler in a vertical position, is transferred from the press conveyor to a set of slow moving belts running on the table. From the bundling table, the signatures are placed in the compressing portion of the unit. When the signature stream has progressed to the correct point (as shown) the flyboy pushes a lift to the compressing end of the table, raises the compressing arms with a treadle valve and compresses the bundle with a hand valve. When compression is complete, the bundle is tied, the compressing arms are released and the bundle removed.

Arms are air operated and when not in use they can be lowered beneath the table to permit passage of a lift over them to the compressing area. The feed which is controlled by a variable speed motor, is continuous from the press to the bundling table. Feed can be adjusted to meet varying requirements imposed by the delivery of different types of stock and various numbers of pages. Unit is available in a single size that handles signatures up to tabloid size and a double type, for two streams delivered side by side. **A. R. Stobb and Son,** 2120 Northwestern Ave., Racine, Wis.
—*Circle 433



Drilling/Tapping Unit

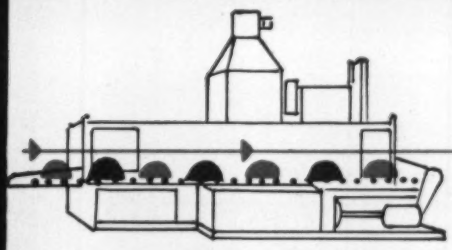
Item 434

Designed to speed up multiple drilling and tapping operations, two-position machine incorporates two vertical and five horizontal units for drilling and tapping 12 holes in three similar parts. Two holes are drilled in one position and ten holes are tapped in the second position.

Operator alternately loads the two machines, completing the drilling operations on a manually clamped fixture on one machine, and tapping ten holes on the second machine which automatically clamps, taps and releases the part. Production rate is 300 parts per hour. **Govro-Nelson Co.,** 1933 Antoinette, Detroit 8, Mich.
—*Circle 434

*For Inquiry Card, see page 17

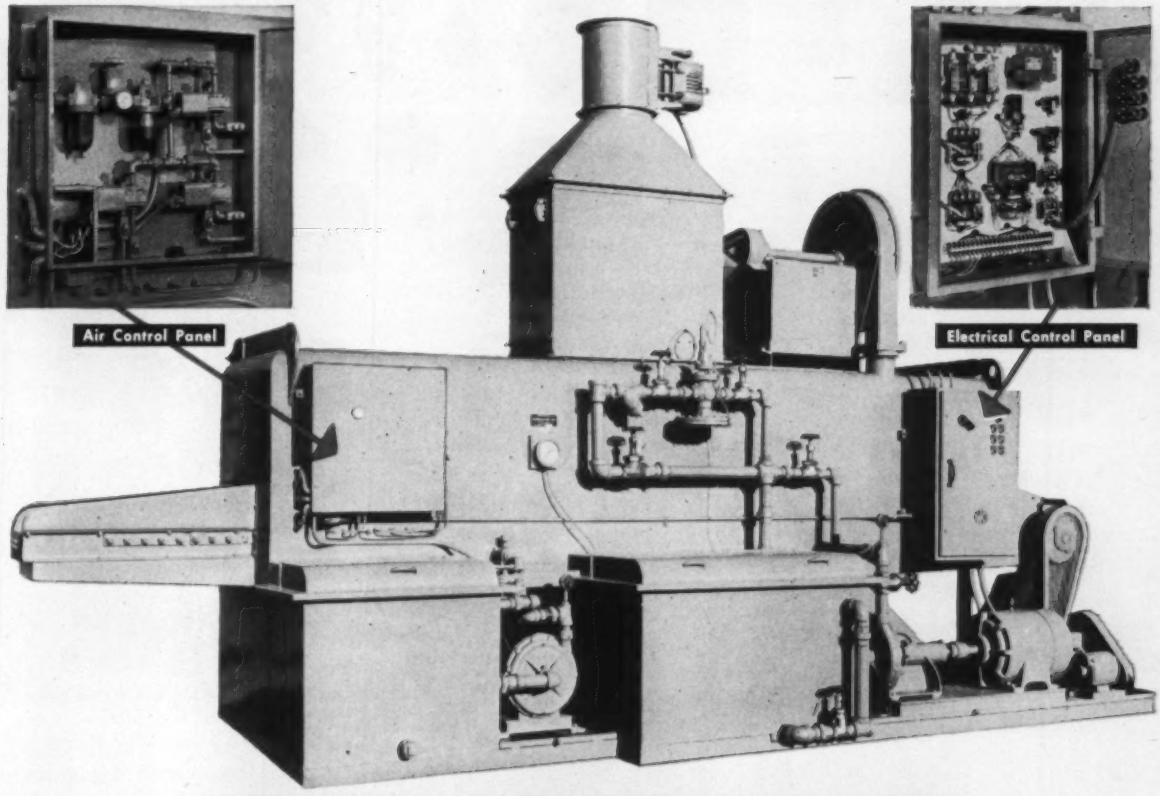
Circle 703 on Inquiry Card→



Automated

3-STAGE WASHER

by PETERS-DALTON



P-D 3-STAGE WASHER FOR TORQUE CONVERTER HOUSINGS

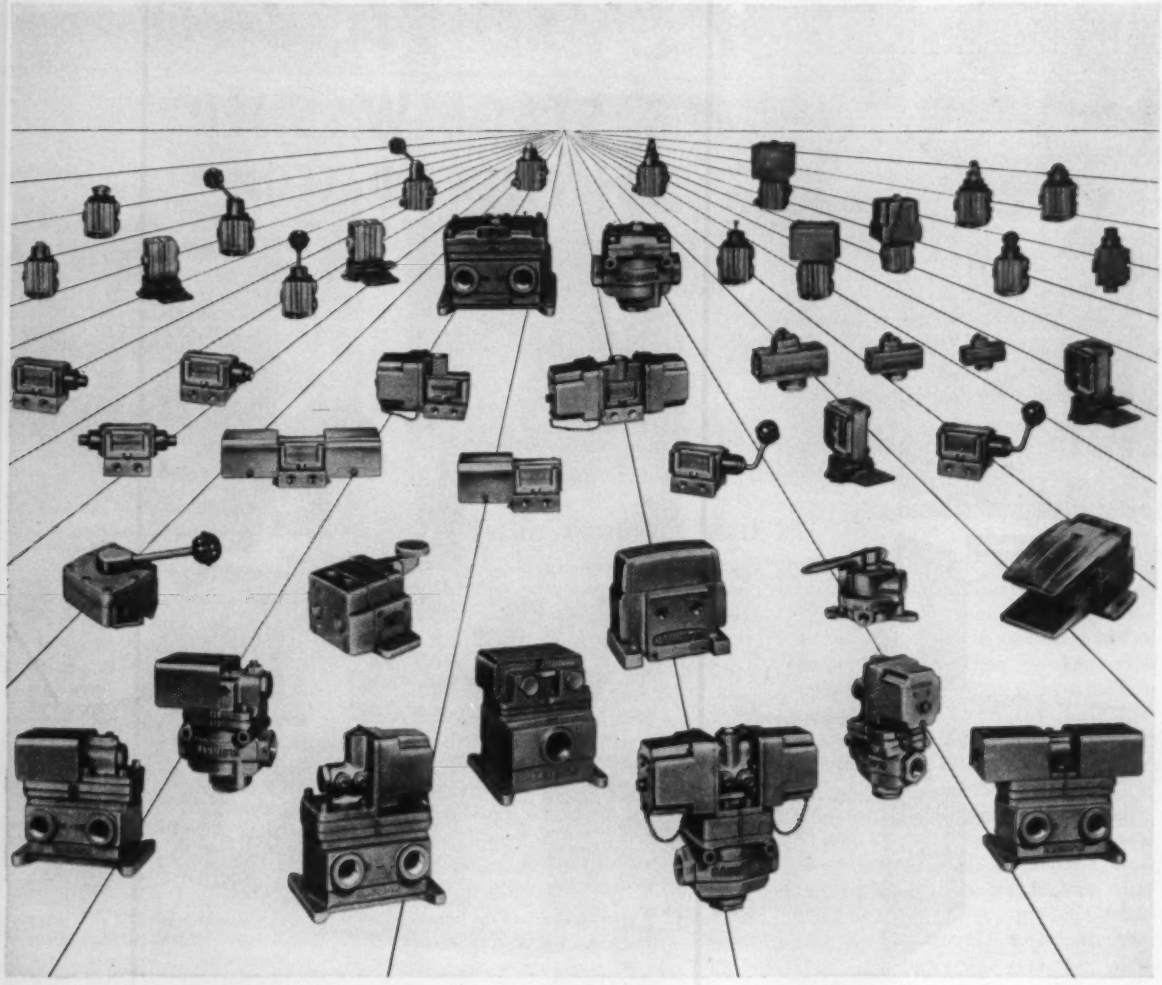
Important savings of time and labor, along with efficient and economical operation, have been made possible through this 3-Stage Washer designed, engineered, built and installed by Peters-Dalton. Its function is to spray-wash both the inside and outside of torque converter housings. The operation is performed in a continuous action—first, the housings are fed to the machine on gravity rolls; then an air cylinder moves them over the inside spray manifold. This same motion holds back the unit following and moves the preceding unit onto a cross-rod conveyor for outside wash. Another cylinder positions each unit over the manifold and blocks the shaft opening. The inside and outside wash are both heated emulsified oil cleaners—room air blow-off removes excess oil. The exhaust has an eliminator and a filter box for entrapping overspray.

Whatever your requirements, finishing equipment to meet every need regardless of size, can be designed, engineered and manufactured by Peters-Dalton to perform efficiently and economically. The knowledge gained through more than a quarter century of designing, engineering and custom manufacturing, is available to you at P-D. Why not send us your specifications or prints? Our reply will be prompt. Just write, wire or phone . . . we'll be glad to tell you more.

Representatives in principal cities.

- *Hydro-Whirl Paint Spray Booths*
- *Industrial Washing Equipment*
- *Drying and Baking Ovens*
- *Hydro-Whirl Dust Collecting Systems*

PD Peters-Dalton INC.
A SUBSIDIARY OF DETROIT HARVESTER CO.
17894 Ryan Road • Detroit 12, Michigan



These valves like tough jobs

Discriminating engineers are finding that out. More and more of them are specifying Hannifin valves for every kind of directional air control—including the really tough jobs.

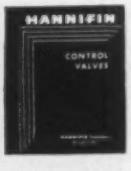
There are plenty of reasons why: Inspired simplicity of design. Fewer parts—and *those* easily and quickly replaceable. Ability to serve a wide range of applications with fewer valve models. And—above all—fast, smooth operation.

Your Hannifin man will gladly give you the whole story. We'll tell you where to get in touch with him—after you examine the big Hannifin catalog.

AIR CONTROL

HANNIFIN

VALVES



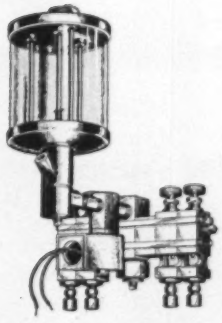
For this complete catalog showing all the Hannifin directional air control valves, write to Hannifin Corporation, 541 South Wolf Road, Des Plaines, Illinois.

Circle 704 on Inquiry Card

AUTOMATION new components

Parts, elements and devices designed for creating more automatic systems

For detailed information and literature, use card page 17.



Precision Lubricator

Item 435

This new automatic lubrication system which feeds one or a series of bearings at a constant rate is afforded by electro oiler. The device eliminates any variation in drop feeding, since the oil which feeds the sight feed valve is always at the same level. This level is maintained in the base of the reservoir.

Operation is based on the liquid seal principle: When the oil level recedes because of oil consumption, the liquid seal on the spout is temporarily broken, allowing air from the air intake to enter the oil reservoir and releasing oil until the seal and the proper level are restored. The constant level of oil insures a steady rate of drop feeding regardless of the amount of oil in the reservoir.

The electro oiler can be supplied with single or multiple sight feed valves for individual flow to each bearing. Up to 24 sight feed valves can be separately adjusted and settings retained by means of a friction screw. Drop feeding of oil to widely separated bearings is controlled and observed from one central point. The solenoid valve is usually wired across the line of the driving motor, starting and stopping with the motor and providing automatic operation. The solenoid can also be energized by a switch or timer. Shutting off the oil supply with the solenoid valve immediately stops the drop feeding of the sight feed valves. **Oil-Rite Corp.**, 2312 Waldo Blvd., Manitowoc, Wis.

—*Circle 435

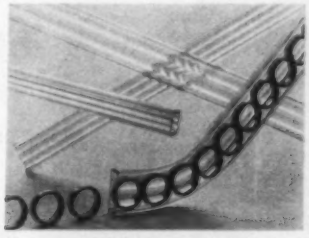
Overload Control

Item 436

Device protects machine tools, dies, motors and stock from being damaged by overload, gives immediate alarm or shutdown when a current increase signals an overload condition. Electromechanical control is built around the positive action of a contact meter-relay. Maximum load to be permitted on the motor being monitored is set by an adjustable pointer anywhere on the dial of the meter-relay. When the pointers meet at an overload position, contacts lock and the circuit is broken. An alarm may be sounded or the machine shut down.

Control features an interlock that keeps the circuit broken after an overload until the condition causing the trouble has been corrected and a manual reset button has been pressed to restart the motor. Circuit will not close if the contacts of the meter-relay unlock for any reason. Load relay is energized when the control is operating; overload causes the relay to drop out and break the circuit through the motor. Unit operates on 115 or 230v input. DPDT slave relay contacts are rated 5 amp per pole, 115/230v noninductive, with optional ratings to 40 amp. **Assembly Products Inc.**, 75 Wilson Mills Rd., Chesterland, Ohio.

—*Circle 436



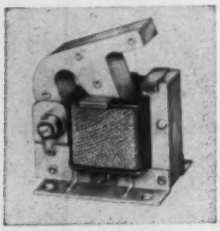
Parts Carriers

Item 437

Use of Plasticarrier tubes allows small parts to be transported from one machine to the next in a production sequence. Tube is adapted to pneumatic, mechanical or gravity methods of conveyance. Extruded of clear, durable Tenite acetate plastic, the tubes withstand the wear of moving parts and the impact at points where conveyor changes direction. Production flow can be observed through the transparent walls. Tubes are available in standard sizes ranging up to 2⅛-inch out-

*For Inquiry Card, see page 17

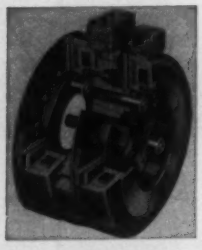
side height with cross-sections to fit a variety of parts. Shaping is readily accomplished by heating to 170-180F. **Jessall Plastics Inc.**, Kensington, Conn.
—*Circle 437



Rotary Action Solenoid

Item 438

Applicable on conveyor belts, electric switches, and toll registers, rotary action solenoid has only one moving part. Electromagnetic circuit permits operation under load over wide fluctuations in voltage. Models are available with usable angle of rotation up to 70 degrees. Torque produced increases as the angle of rotation diminishes. Magnet coils are wound on molded phenolic bobbins, with a thermal device built in to prevent damage to surroundings by smoke and fire in case of overload. **Roto Mfg. Co.**, 1030 W. 2nd St., Xenia, Ohio.
—*Circle 438

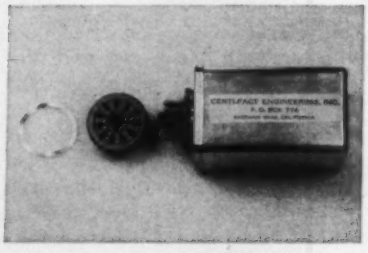


Magnetic Clutch/Brake

Item 439

Device applicable in machine tools, material handling equipment, packaging machines and textile and paper processing equipment. Electrically operated, disc-type friction units have two basic components, field magnet and armature. Torque is transmitted between these components as the magnet pulls the armature into engagement with the field magnet assembly. Rapid response in clutching or braking results because the pull of the magnet is direct, without intricate linkage, and the movement of the armature is slight.

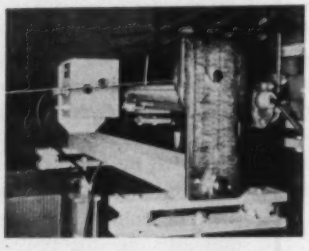
Unit allows rapid operation without backlash or chatter, automatically maintains proper clearance between armature shoes and field magnet, operates on 110, 220 or 440v, 60 cycle ac. **Dynamatic Div., Eaton Mfg. Co.**, Kenosha, Wis.
—*Circle 439



Coincidence Relay

Item 440

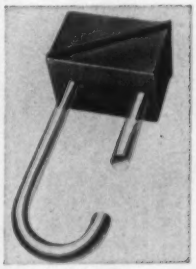
Model CR-1 provides fail-safe continuous monitoring of three external normally closed signal or alarm circuits. The opening of any two of the three monitored circuits de-energizes the relay. The relay resets only when all three circuits are normal or in the closed position. Unit is plug-mounted, and is enclosed in a dust-resistant, plated metal housing. Contacts are double pole, double throw, 10 amp, 115 v ac. Coil operates on 115v dc, continuous duty. **Certi-Fact Engineering Inc.**, P. O. Box 774, Sherman Oaks, Calif.
—*Circle 440



Yarn Break Detector

Item 441

Device detects a broken end of yarn in multistrand textile beaming operations. When a break is detected, the beamer is stopped automatically. Highly sensitive photoelectric scanning system eliminates scuffing of yarn. Damaged yarn is minimized and tension reduced by elimination of the individual yarn guides needed for mechanical-type detectors. **Lindly & Co.**, Mineola, N. Y.
—*Circle 441



Sensing Probes

Item 442

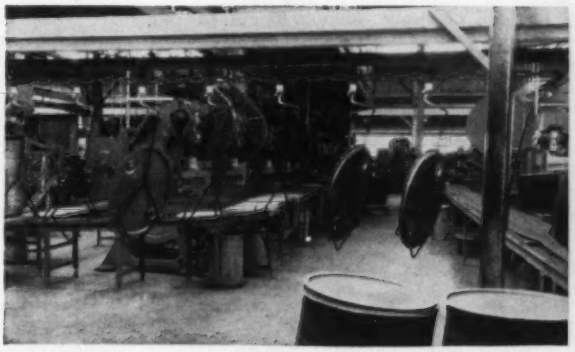
Positioning of photoelectric pick-ups at points difficult to reach is simplified by photoelectric sensing heads with light conducting Lucite probes. Probes are attached in proper alignment to a case containing phototube and light source lamp. Case can be mounted with the probes projecting into inaccessible areas. Phototube and light source can be housed separately and the probes projected into pick-up area from different directions. **Autotron Inc.**, Box 722-RR, Danville, Ill.
—*Circle 442

Time Delay Switches

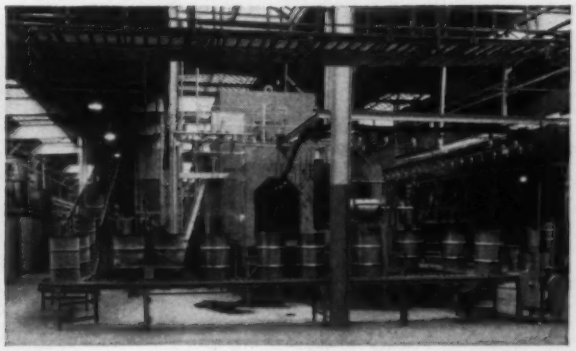
Item 443

Suitable for use with magnetic relays; switches operate thermally and delay can be set at any point within the limits of the timing range by means of an adjustment screw that varies the contact gap. Two types of switch are available; one provides immediate recycling; the other does not. Difference be-

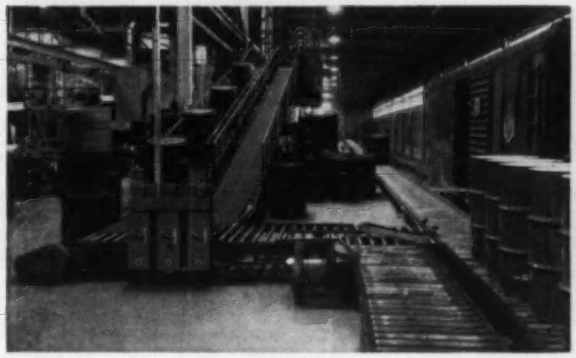
*For Inquiry Card, see page 17



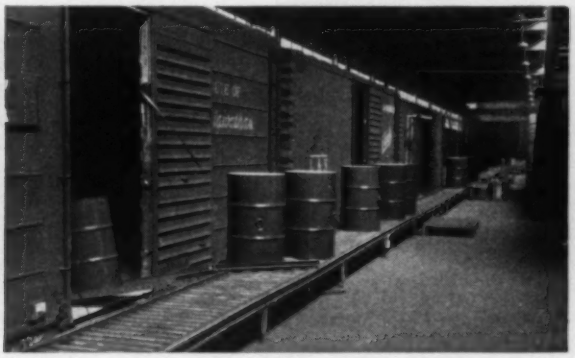
Drum heads move like clock-work during forming operations via Alvey conveyors at U. S. Steel's new Camden plant. Conveyor movement is so well synchronized and coordinated, not a minute's production time is wasted.



Drum shells emerge from wash unit on their sides, are upended . . . then travel along Alvey live roller conveyors to incline belt, which carries them to another area for further processing.



Drums, en route to loading dock, move down Alvey declined conveyor and smoothly transfer to horizontal conveyor. Exclusive declined conveyor design permits easy, "floating" ride, with no bouncing or jamming up at point of transfer.



Alvey roller conveyors along railroad siding feed finished drums into box cars. System enables U. S. Steel Products to load up to 26 cars, inside and outside of building. Similarly, 12 trucks can be loaded at nearby loading dock.

High-speed steel drum production . . . low-cost handling with Alvey-Engineered Conveyor System . . . at U. S. Steel Products Div. Camden Plant

U. S. Steel Product's objective: high-speed, streamlined production and highest materials handling efficiency at their Camden, New Jersey plant with lowest possible handling costs. Alvey's answer: a completely coordinated Conveyor System. Results: maximum drum and pail production; plus a minumim of handling costs.

From unloading of raw materials to the shipment of finished products, this plant is a conveyor-integrated manufacturing operation. More than 6000 feet of Alvey conveyors automatically carry drums and pails up and down, through baking ovens, and on through various production lines to rail and truck loading docks for shipment. Time-saving Alvey equipment, such as inclined conveyors, belt conveyors, live roller conveyors, have enabled U. S. Steel Products to achieve split-second synchronization . . . *completely* automatic materials handling.

Whether you require an individual conveyor or a complete system, Alvey can meet your exact needs. Experienced Alvey engineers will give you full details . . . write or wire today!

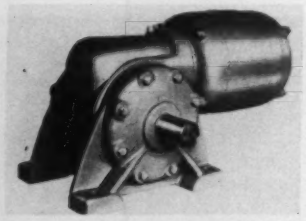
ALVEY

292

ALVEY CONVEYOR MANUFACTURING COMPANY

9373 OLIVE STREET ROAD • ST. LOUIS 24, MISSOURI • *Branch Offices in Principal Cities*

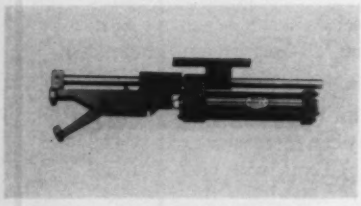
tween the two is that the immediate recycling type has two sets of contacts, one normally open and one normally closed. The other type has one set of contacts, normally open or normally closed. Both can be supplied with contacts rated 1 or 2 amps at 115v ac. For applications where an accurate delay is required over widely varying ambient conditions, switches with temperature compensation are offered. **Betts & Betts Corp.**, 213 W. 14th St., New York, N. Y.
—*Circle 443



Right-Angle Gearmotors

Item 444

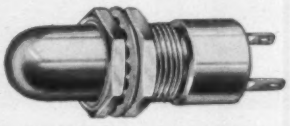
Especially suitable for lighter pieces of machinery, and food and chemical applications, gearmotors are available from ¼ to 5 hp. Heat treated aluminum casting absorbs the high torque characteristic of gearmotors, has good heat transfer properties and is corrosion-resistant. High thrust and radial capacity is obtained through tapered bearings on the output shaft. Gearmotors are available foot mounted (shown) or ring mounted. **Sterling Electric Motors Inc.**, 5401 Telegraph Rd., Los Angeles 22, Calif.
—*Circle 444



Press Unloading Unit

Item 445

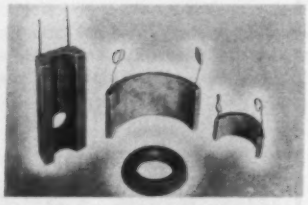
Redesigned jaws have smaller gripping area for greater gripping force, with self-clinging steel inserts. Piston rod end piece allows the jaw to float independently of the cylinder. Back cushion of the cylinder can be removed or replaced quickly. All parts are tooled for interchangeability. **Sahlin Engineering Co. Inc.**, Birmingham, Mich.
—*Circle 445



Pilot Light

Item 446

Compact unit uses subminiature neon glow lamp. Model NE2D draws as little as 0.0002 amp, consumes about 0.04 w of power, has a life expectancy of 25,000 hours. Overall size of light is ¾-inch by 1¼-inch; mounts in 17/32-inch clearance hole from front of panel. Cap of high-heat plastic provides 180 degree visibility. **Dialight Corp.**, 60 Stewart Ave., Brooklyn 37, N. Y.
—*Circle 446

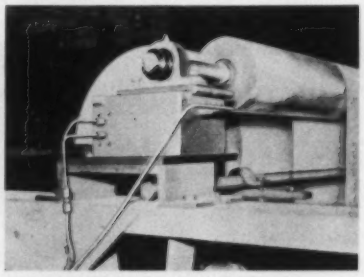


Electric Heating Units

Item 447

Suitable for pipe, tube and tank heating, electric heating elements are composed of resistance coils embedded in a processed material which, when molded and fired at high temperature, results in a strong ceramic block capable of withstanding high operating temperatures. Cylinders are designed to fit closely around pipes to obtain the greatest possible heat flow.

One advantage of heating elements of this type is that the ceramic protects against atmospheric attack on the wire. Coils can be preformed to provide differential heat release at predetermined parts of the block, and diffusion by the ceramic of the heat generated in the coils eliminates hot spots. Embedding ceramic also protects the coils from damage by spatter, flaking or iron oxide where ferrous materials are being heated, and destruction due to inadvertent physical contact or dust accumulation. All elements are provided with terminals or enlarged cross-sectional area to prevent overheating where the terminals extend through the insulating walls. **Cooley Electric Mfg. Corp.**, 50 S. Shelby St., Indianapolis 7, Ind.
—*Circle 447

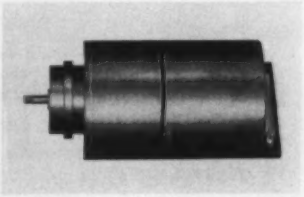


Tension Control System

Item 448

Applicable with air - actuated clutch or brake, unit measures and controls web tension directly within a transmitter. The web of material is passed over a load sensing roll that is supported on one end by a journal mounted on the sensing transmitter.

Features include accurate tension load range from zero to 2000 lb; positive response to load changes; simple operating method and compact control panel. **Pneumatic Applications Co.**, 75 Meadow Plains Rd., Simsbury, Conn.
—*Circle 448

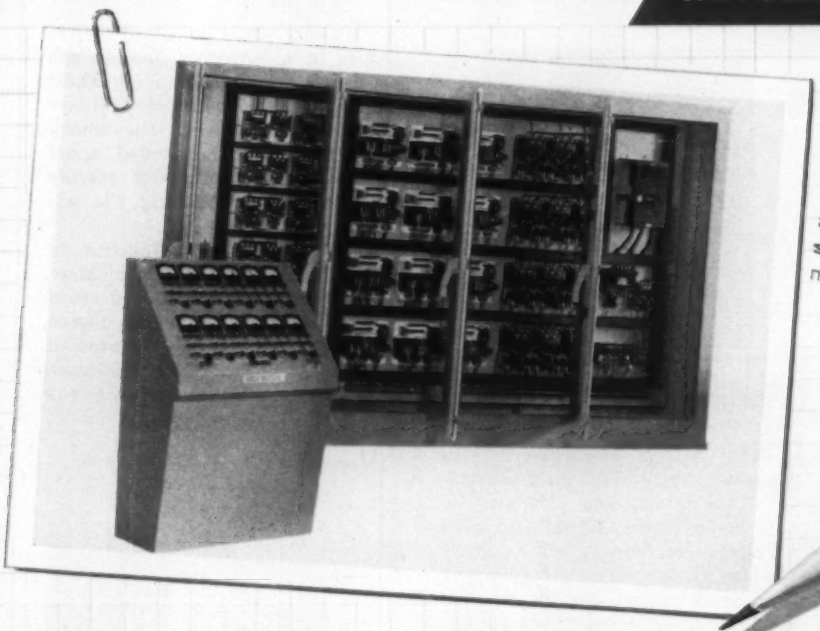


Shaft Position Encoder

Item 449

Applications of this unit include automatic tracking, servo, automatic machine control, and naviga-

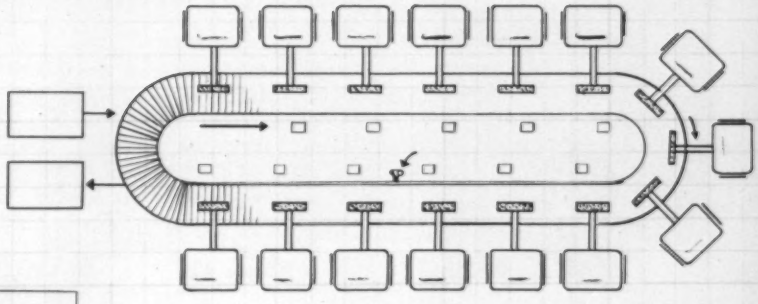
*For Inquiry Card, see page 17



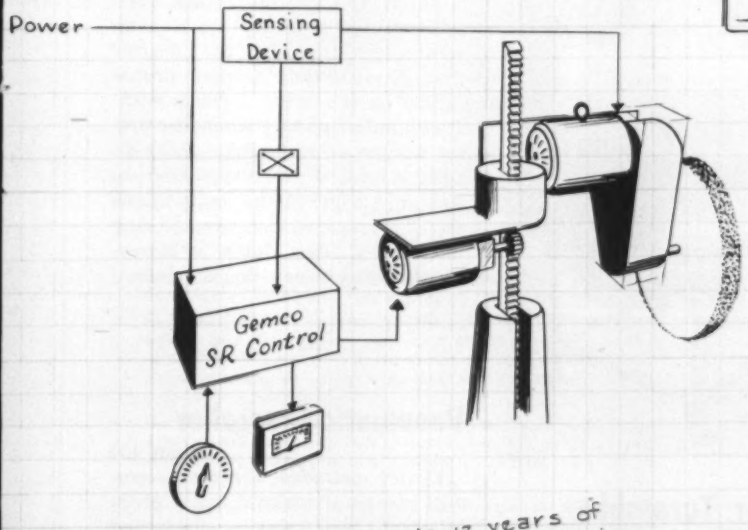
The operator of this Gemco console can pre-set the optimum load on any of 12 polishing spindles and be sure it is maintained. A separate panel holds all necessary switchgear.

GEMCO SR* HOLDS PRE-SET LOAD

(1) A continuous conveyor feeds clamped parts to each spindle.



(2) Optimum polishing power is pre-set with* Gemco saturable reactor control for each spindle.



(3) Once during each conveyor cycle, a switch dog mounted on the conveyor, cuts a sensing circuit into each spindle motor input.

(4) If buffer wear has caused power drop, the saturable reactor feed-back circuit energizes the spindle feed motor.

(5) When optimum spindle power is again reached, down feed stops.

(6) Gemco's 12 years of specialized automatic control experience may solve your problem. Call, wire or write.

GEMCO

CUSTOM CONTROLS

GEMCO ELECTRIC COMPANY

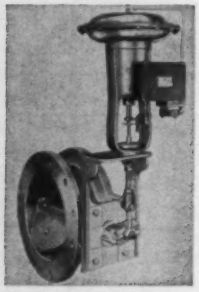
25681 W. 8 Mile Rd. • Detroit 40, Mich.

Circle 706 on Inquiry Card

tion systems. It can be used to read a shaft position in digital form either to record such position on magnetic or punched tape or to apply it to a digital computer. Model RD-13 consists of a glass disc coded by an array of opaque and transparent segments, a flash lamp to illuminate a radius of the code disc, a multielement photosensitive detector to detect presence or absence of illumination and a 13 channel transistor preamplifier.

Encoder provides angular position data in cyclic binary code to an accuracy of 13 digits or better than 3 minutes of arc. Unit has a separable preamplifier assembly that can be removed by releasing one fastener. Each of the 13 transistor amplifier channels is encapsulated separately and can readily be replaced, as can the flash-lamp assembly. **Adcon Inc.,** 1117 Commonwealth Ave., Boston 15, Mass.

—*Circle 449

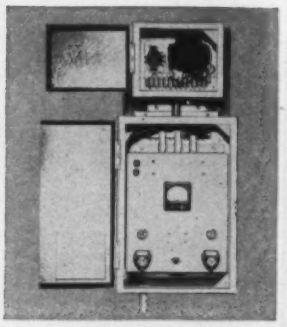


Valve Operator

Item 450

Adaptable for connecting automatic control operators with butterfly valves, bracket and linkage arrangement reduces power requirements in close control applications. Unit has rod end bearings for lateral movement of the linkage necessary in changing from straight line to rotary motion. Device can be used for mounting diaphragm type air operators of all sizes and, with suitable extension, can be used for valves in vertical or horizontal pipe line. Assembly increases range of control and allows quick reproduction or duplication of valve setting. **W. S. Rockwell Co.,** 200 Eliot St., Fairfield, Conn.

—*Circle 450



Machine Load Control

Item 451

Unit controls tool feed, detects jamming, tool wear, faulty lubrication and stops the machine or sounds an alarm. When connected to a recorder, TorqueTrol registers the length of time the tool has been used, indicates work machine performed and when it idled; connected to a counter, counts machine's work strokes and number of parts produced. Device also controls feeds for step drilling, starts the chip clearing cycle or, on a press, warns of excessive die pressure.

Any abnormal condition in the machine operation increases the electrical power demand on the drive motor; unit detects increase and stops the machine. Device is rated at 110-440v ac, 50/60 cycles. Current range is 0.2-100 amp. **Electronic Control Corp.,** 1573 E. Forest Ave., Detroit 7, Mich.

—*Circle 451

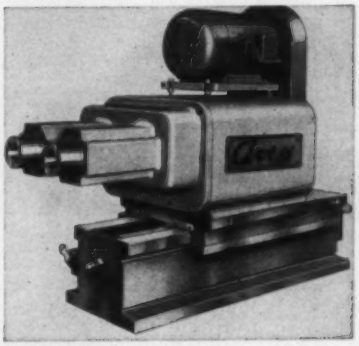
Conveyor Turntable

Item 452

Unit suitable for use in handling various width skids and platforms or turning them at various angles in a conveyor line. It can be used to permit banding skids and boxes by allowing steel straps to be passed between the wheel-rails. Rails can be moved apart or brought together by merely loosening and tightening the adjusting nuts.

The turntable is 40-inches in diameter and 36-inches high. Manually operated spring-loaded stops are mounted at each 90 degree point. The unit can be inserted in a conveyor line to divert packages at various angles. **Sage Equipment Co. Inc.,** 30 Essex St., Buffalo, N. Y.

—*Circle 452



Drilling Attachment

Item 453

Device eliminates drill breakage during deep hole drilling. Design allows the exact setting of torque on deep hole drilling units. Attachment is calibrated so a number corresponds to the desired drill diameter and assures proper torque on the drill. Drill is withdrawn automatically whenever preset torque is exceeded. Drill diameter charts corresponding to Metric Torque-Matic calibrations can be prepared for any drilling job. **Avey Div., Motch & Merryweather Machinery Co.,** Cincinnati 1, Ohio.

—*Circle 453

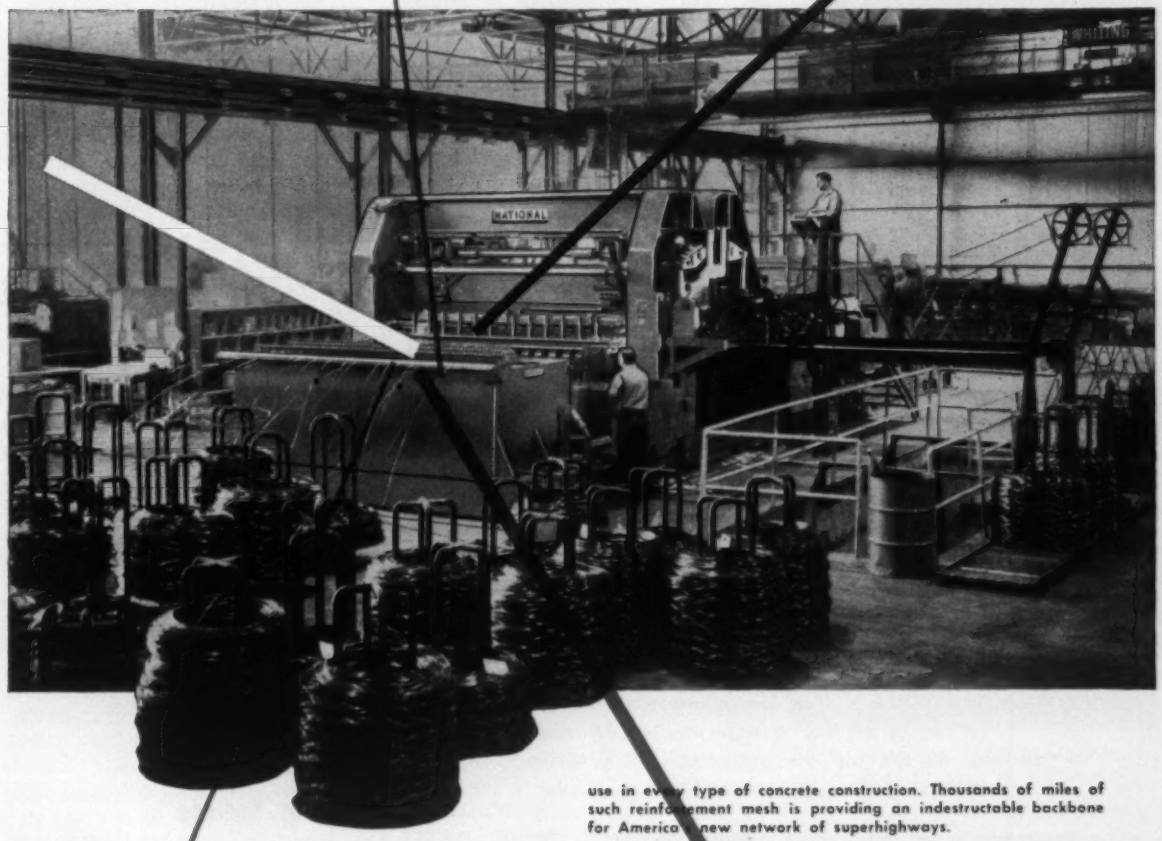
Pneumatic Controller

Item 454

Device provides accurate, compact means of maintaining a given set point by relaying measured variables for subsequent corrective action via a final control element

*For Inquiry Card, see page 17

this NATIONAL ELECTRIC UNIT is a completely automatic high speed wire mesh manufacturing plant



Starting with coils of line-wire, this National Electric Wire Fabric Welder automatically turns out welded wire mesh in a variety of sizes . . . and at surprising speeds. In a single hour, as much as 250 miles of wire is transformed into high-quality wire mesh for all kinds of uses including reinforcement in concrete construction, fencing, etc.

Beginning at a line wire straightener unit, each wire is passed over as many as 10 grooved, staggered rollers for straightening.

Next, the line wires pass over welding dies within the machine's welding unit. Here, under a pressure of 60,000 lbs., a mat as wide as 200" is welded at each junction-point, the cross-wires being fed in automatically, at whatever spacing may be indicated by the reciprocating indexing-platen.

The machine next shears rectangular mats to the required size or winds welded fabric into coils of desired length. Finished coils are automatically discharged onto a ramp . . . rolling away to the loading dock or warehouse.

The rugged, steel-mill design and construction of this machine makes it possible to efficiently weld as many as 120 cross-wires per minute. Since 1945, National Electric Wire Fabric Welders have been dependably turning out welded wire mesh in numerous sizes, for use in every type of concrete construction. Thousands of miles of such reinforcement mesh is providing an indestructable backbone for America's new network of superhighways.

Complete automation, the key to profitable production, is made possible in National Electric Welding machines by means of utilizing automatic feeds, radial feeds, automatic positioners, multi-head design, automatic discharge devices, motor-driven rotating fixtures and sequenced ejectors. By their speed and accuracy, National Electric machines achieve amazing savings in time, labor, and cost-per-weld.

Write today for complete information on National Electric Automatic Wire Mesh Welders or any other special or standard welding problem that you may have.

50

NATIONAL

ELECTRIC WELDING MACHINES CO.

1870 N. TRUMBULL STREET

BAY CITY, MICHIGAN

25 YEARS EXPERIENCE DESIGNING AND BUILDING: SPECIAL & STANDARD • AIR • HYDRAULIC • MOTOR DRIVEN • SPOT • PROJECTION • SEAM • BUTT • FLASH • RESISTANCE WELDERS • PRODUCTION FIXTURES FOR ALL TYPES OF AUTOMATIC ARC WELDING.

Does Your Conveying Equipment Put LIFE in your Plant?

Materials handling methods that use conveyors merely to aid or replace muscle are helpful accessories . . . but they do not tap the potential of a plant-wide conveyor system—"engineered for movement."

At every point throughout production, an A-F *Engineered* Conveying System puts *Life* in your plant. It is "*Engineered Movement*" that produces greater efficiency, greater profit!

Perhaps it's time for you to throw out those obsolete accessories and replace them with A-F "*Engineered Movement.*" Reduced operating and maintenance costs—plus increased plant and worker output—could well justify the investment.

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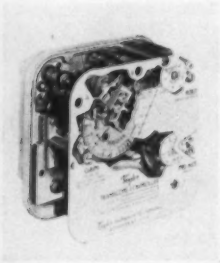
A-F *ENGINEERED* CONVEYING SYSTEMS

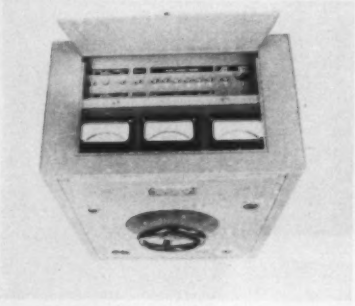
Also Pre-Engineered Conveyors—Wheel, Trolley, Roller, Belt Metal Cleaning and Processing Machines

THE ALVEY-FERGUSON CO., 174 Disney St., CINCINNATI 9, OHIO and Azusa, California



such as a diaphragm valve or lever motor.

Controller uses the motion-balance principle through interconnected multiple bellows and springs acting on a common force plate. Plug-in feature makes possible mounting to a separate manifold located either at the point of measurement or the point of control. It offers complete interchangeability of unit parts and is available with single or multiple control responses. **Taylor Instrument Co.**, 95 Ames St., Rochester 1, N. Y. —*Circle 454



Power Source

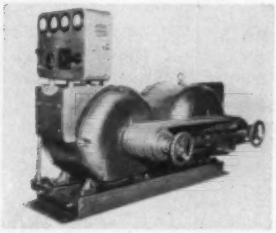
Item 455

Suitable for use in laboratories, production testing lines, or maintenance departments, test set provides a compact source of adjustable ac voltage with accurate instrumentation. Control switches are located inside the top of the cabinet. In the *on* position the switch causes the voltage coils to be connected to the load in a manner determined by the positions of the voltmeter and wattmeter voltage coil connections. In the *off* position the voltage coils are disconnected from the circuit, eliminating from the ammeter reading the extra current drawn by the coils. A safety feature is a sepa-

*For Inquiry Card, see page 17

rate equipment grounding circuit provided through the input connector.

Portable unit is 60 cycle, 120 or 240v. Eight current ranges from 0.5 to 100 amp are provided, with corresponding power ranges up to 12,000w. **Dayton Electric Mfg. Co.**, 114 S. Oakley Blvd., Chicago 12, Ill.
—*Circle 455

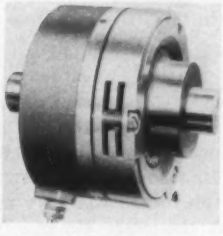


Motor-Generator Unit

Item 456

Device supplies alternating current output at 360 to 440 cps. Double-motion variable-pulley drive arrangement on motor and generator allows speed variance of alternator rotor while both machines remain stationary on mounting frame. Generator frequency is 400 cps at 1714 rpm, 440 cps at 1884 rpm, and 360 cps at 1544 rpm.

The 400 cycle generator has an output of 30 kw, 3-phase, 120/208v and is the revolving field type. Excitation current is supplied by a 1000w, 125v, dc exciter, direct connected to the alternator drive shaft. Motor is induction type and operates from 3-phase, 60-cycle current. **Kato Engineering Co.**, 1415 First Ave., Mankato, Minn.
—*Circle 456

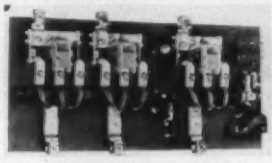


Electric Clutch

Item 457

Designed for machine tools, paper and textile machinery, magnetic clutches are available for wet or dry applications. Oversized bearings are factory sealed, insure extra capacity and require no lubrication. Setscrews allow easy positioning and installation, with the stationary magnet body anchored against rotation by a strap assembly. Clutch can be driven from either end.

Clutches can be actuated with automatic or manual controls such as pushbuttons, limit switches or photoelectric devices. Plug-in electrical connections to the nonrotating magnet body eliminate the need for slip rings or brushes. Units are available in slip torque ratings from 9 to 540 lb-ft. **Stearns Electric Corp.**, 120 N. Broadway, Milwaukee 2, Wis.
—*Circle 457



Heat Control Panels

Item 458

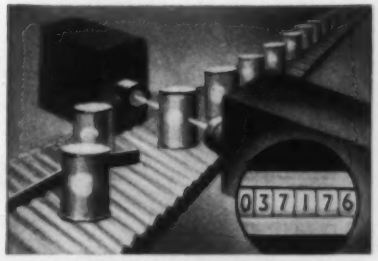
Unit designed for control of all types of industrial electric heaters and furnaces. Temperature sensing devices are available in two wire and three wire high-low type. With input controller devices, contactor operates at a predetermined rate of time-on, time-off, to maintain temperature. Panels are rated in amperes per pole for all types of industrial electric heater loads. Standard listings are from 30 to 400 amp to 600v ac; special panels are available to 1000 amp, for higher frequencies, and for dc. **Automatic Switch Co.**, Florham Park, N. J.
—*Circle 458

Flow Meter

Item 459

Flow cell and responder suitable for measuring, and recording rate of flow of acids and alkalis, explosive fluids, inflammable gases and natural gases and slurries. Model FM 100 measures the rate of heat transfer through the boundary layer of a liquid or gas flowing

*For Inquiry Card, see page 17



DEPENDABILITY... WHERE IT COUNTS

RCA Phototubes

For long-term dependability in light-actuated equipment, specify RCA Phototubes. They offer a proven record of faithful service in applications involving light measurements, scintillation counting, color matching, and sound reproduction.

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- **Hundreds of other designs** for both AC and DC application.
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THOMAS can build Trucks and Trailers that meet your exact needs

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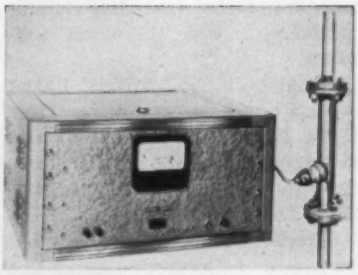
THOMAS TRUCK & CASTER CO.

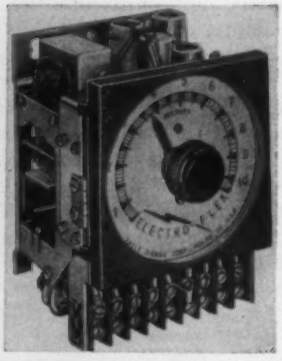
718 Mississippi River • Keokuk, Iowa

THOMAS MAKES ALL KINDS OF TRUCKS, SKIDS, CASTERS AND WHEELS



through a smooth bore flow cell. Measuring elements are completely separated from the fluid by the walls of the flow cell, and thus are protected against chemical and mechanical attack by the stream. Small flow rates of the order of a few pounds per hour and less can be measured. Flow rates of highly viscous materials such as urethane prepolymers, glues, oils and other hydrocarbons are easily measured.

A constant temperature differential is maintained at all flow rates by means of a self balancing bridge. The wattage is automatically varied by the electronic control system in response to the varying flow rates. **Industrial Development Laboratories Inc.,** 17 Pollock Ave., Jersey City 5, N. J. —*Circle 459



Reset Timer

Item 460

Unit is designed to accurately time short intervals from 0.05 second to 10 seconds. The armatures of two relays are the only moving parts on the reset timer.

The dial is calibrated directly in seconds and may be set with a high degree of accuracy. Timing accuracy is maintained within 2% of the initial setting, allowing for

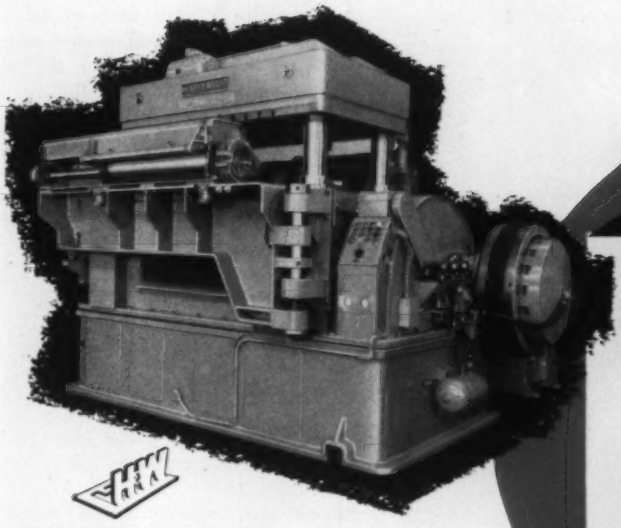
*For Inquiry Card, see page 17

HENRY & WRIGHT

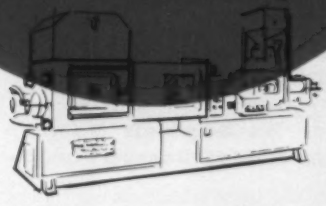
a great name in
metal stamping processes

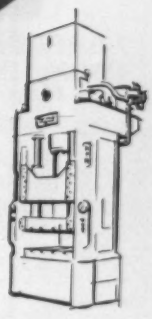
JOINS

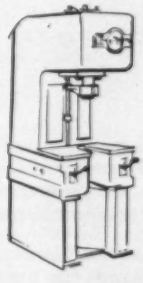
HPM

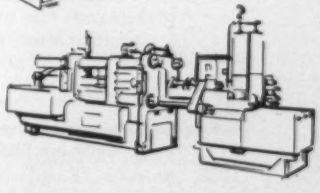


This is the new H & W Double Crank, 350 ton dieing machine which is designed to extend the economies of progressive metal stamping.









Here's a combination of two great names in the metalworking industry—each with a tradition for service to specialized fields—each with a reputation for quality and the finest in machine design.

Henry & Wright Dieing Machines offer better, faster production to more uniform specifications than ever before. The new double crank H & W's provide greater flexibility in stamping. Greater precision and longer die life result from the improved design of these versatile machines. The H & W you buy today has the benefit of years of experience behind it; the combined personnel of H-P-M and H & W, with background covering both the mechanical and hydraulic fields, offers the finest "one-two" punch in the industry for your complete stamping and forming requirements.

Make H-P-M your headquarters for presswork production equipment. Now, more than ever before, there's an H-P-M designed for your job.

HPM

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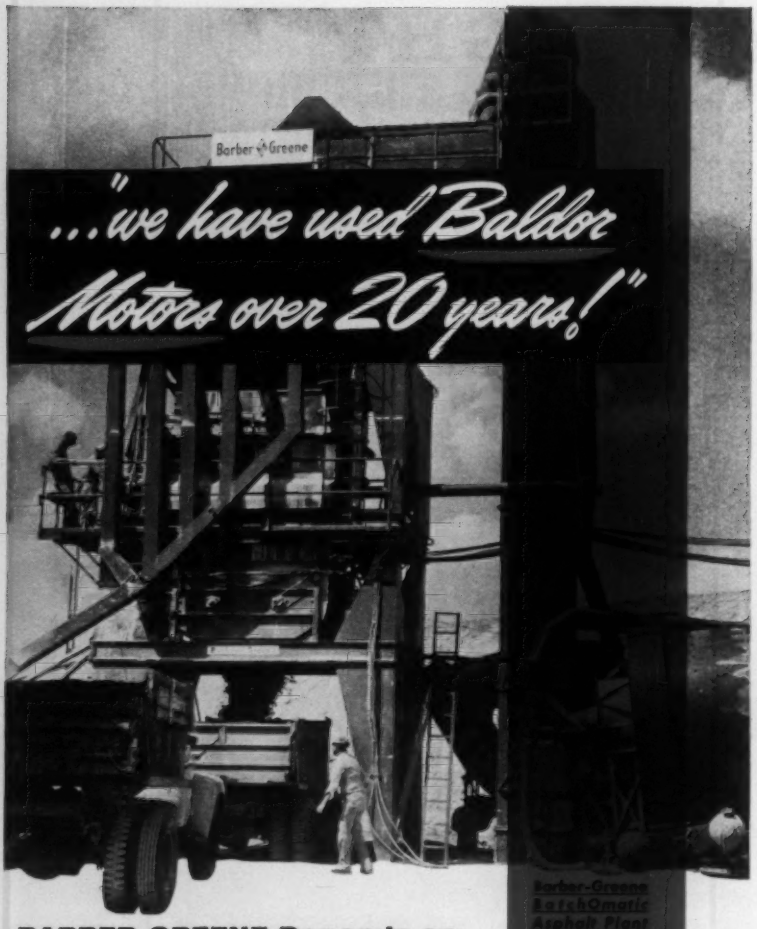

Barber-Greene BatchOmatic Asphalt Plant

Up to 6 Baldor Streamcooled Motors are used to power these gigantic machines

BARBER-GREENE Depends on Baldor Streamcooled Motors to Power Its Asphalt Batch Plants & Belt Conveyors!

Despite the most torturous use, plus the constant hazard of dust and dirt, Baldor Streamcooled Motors keep famous Barber-Greene equipment operating at top efficiency, day after day.

This kind of superior performance has earned Baldor an enviable reputation among many outstanding heavy equipment manufacturers.

If you have a power problem that demands the utmost in motor performance, perhaps Baldor can help you, too!

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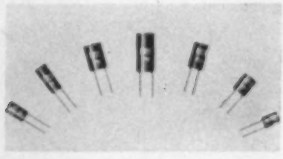
Circle 713 on Inquiry Card

voltage variation of −15% to +10%, temperature changes of 70F to 140F, tube replacement or nominal vibration and humidity.

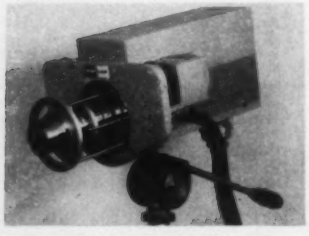
Remote control is available in two variations. The dial can be removed from the timer and located remotely as needed or a kit for remote control dial of comparable size to a pushbutton station is available. **Eagle Signal Corp.**, Dept. 1, Moline, Ill.
—*Circle 460



Flat-Top Resistors

Item 461

Precision components designed for easy, rapid mounting on printed circuit panels with no support required other than the wire leads. Model P is a single ended, miniature resistor available in 7 sizes, from ¼-inch diameter by 5/16-inch long. Ratings from 0.1w to 0.4w, resistance to 3 megohm. Can be operated in ambient temperatures to 125C. **Resistance Products Co.**, 914 S. 13th St., Harrisburg, Pa.
—*Circle 461



TV Lens Control

Item 462

Remote control device provides vibration-free control of industrial TV camera lens aperture and focus. Operations are accomplished from a modular control panel. Control panel can be mounted in the monitor or in a remote control mounting panel. Camera unit can be positioned several thousand feet from the remote con-

*For Inquiry Card, see page 17

Setko's 21 Years of Progressive Engineering Keep Set Screws As Modern As Tomorrow's Products

Set Screw News

& Mfg. Co.

We Specialize in Solving Puzzling Set Screw Problems

Issue No. 7 | Bartlett, Illinois (Chicago Suburb) | Automation Edition

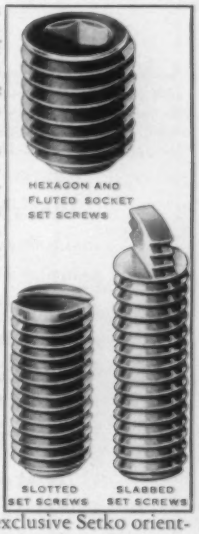
Now... Starring in a Dramatic New Automated Role ... HOPPER FEEDING of HEADLESS SET SCREWS!

Preview the Automation in your future . . .

Got 12 minutes? That's all the time it takes to view the new 16 mm full color Setko movie that demonstrates the amazing facts of the new Setko System for hopper feeding of headless set screws. The illustrations at the left show some important scenes from this timely film. This new film is available for showing in your plant or office, so that you can readily see what other manufacturers are already doing to use this new system to cut costs and boost production. Use the coupon, or write directly to Set Screw & Mfg. Company for a "demonstration" . . . there's no cost or obligation on your part, or ask for a free copy of Catalog 21, with complete data on Setko Hopper-Fed Headless Set Screw System.

Headless set screws can now be hopper-fed! This dramatic fact brings the economies and higher production of automation to sub-assembly operations in all kinds of industry. With the new Setko Hopper Feeding System, setting and driving of headless set screws can be completely automated . . . at very low cost.

This revolutionary new system cuts operation time from 80% to 90%. With Setko innovations in control, complete uniformity of sub-assembly is effected. Floor waste that now runs as high as 30% is eliminated . . . floor area is dramatically reduced . . . worker morale zooms with the ending of tedious hand feeding and driving.



The Setko System is simple and practical. It eliminates cross threading, jamming, and there are no skips or misses. It will provide safe, sure hopper feeding of set screws as small as #2 (.086" x 1/8"). In addition to the exclusive Setko orienting device, Setko innovations that make this system foolproof include air feed . . . micro-switch control of driving . . . photoelectric control of screw flow. Both vertically-fed and horizontally-fed models are available that can readily be adapted to present equipment such as rotary indexing work tables, drill presses, vertical tapping machines, etc. Individual requirements can be met by providing fully automatic, semi-automatic, or manual actuation of driver.

SET SCREW & MFG. CO.
266 Main St., Bartlett, Ill.

1856

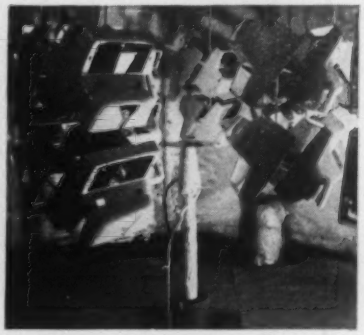
Please send your new Catalog 21. Also:
☐ Advise how and when I can view free demonstration of Setko Hopper-Fed System.

NAME_____

COMPANY_____
(Write address in margin of this page)

Circle 714 on Inquiry Card

IBM relies on **RANSBURG NO. 2 PROCESS Electrostatic Spray Painting** to get the excellent and uniform high quality wrinkle finish on all **IBM ELECTRIC TYPEWRITERS**



Both prime and finish coats are uniformly applied to IBM Electric Typewriter cases as they rotate around the floor-mounted Ransburg No. 2 Process reciprocating disks. Automatic Electro-Spray provides three times as many pieces per gallon as by former hand spray.

IBM's strict quality standards are easily maintained with Ransburg No. 2 Process in the painting of Electric Typewriter parts. Rejects by the former hand spray method used to run as high as 30% on some parts. Now, with automatic Electro-Spray, rejects for all reasons are only 3% to 5%.

Three Times as Many Pieces per Gallon!

Along with increased production, paint mileage is stepped up, and they get three times as many pieces per gallon as by the former hand spray method. That's because efficiency of the Ransburg No. 2 Process Reciprocating Disk puts the paint where it's supposed to go . . . on the parts.

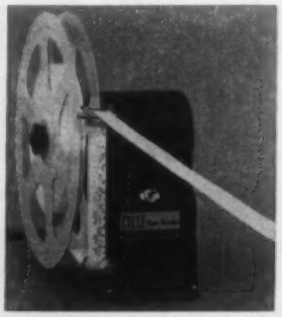
Want to know how Ransburg Electro-Spray can improve the quality of your painted products . . . and at the same time, cut your paint and labor costs? At no obligation to you, we will make complete laboratory tests with your products to prove the advantages and cost saving benefits which can be yours with Ransburg No. 2 Process. Write or call.

Ransburg ELECTRO-COATING CORP.
Indianapolis 7, Indiana

RANSBURG

Circle 715 on Inquiry Card

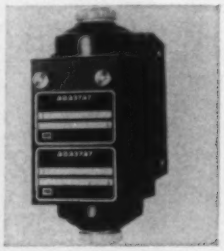
trol panel, connected by a control cable. Input power for Model ARC-1 is 110v, 60 cycle, 17w. **Kin Tel,** 5725 Kearny Villa Rd., San Diego 11, Calif.
—*Circle 462



Tape Winder

Item 463

Instrument handles message tape for communications systems. Delayed-action winding produces uniform tension, and clutch release allows tape to be run out for back reference without excessive tension. Units are power-driven and static-free, can handle a wide range of tape widths and types. **Cycle Equipment Co.,** 17480 Shelburne Way, Los Gatos, Calif.
—*Circle 463



Time Delay Relay

Item 464

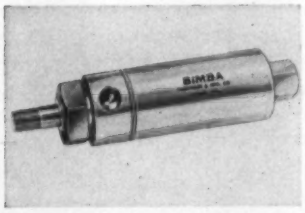
Unit is adaptable in laboratory equipment, and various operations requiring continuous automatic recycling. Adjustable recycling is accomplished by the two-way action of the Agastat time delay relay. With two timing heads, a separate time delay can be set on each to allow an adjustable *on* and *off* from 0.1 second to 15 minutes.

Time delay occurs upon energization of the upper portion of the

*For Inquiry Card, see page 17

relay. At completion of the delay interval, a switch breaks one set of contacts and makes another. The switch remains in the transferred position as long as the control circuit is energized. At de-energization, the unit recycles slowly, depending on the time delay setting of the lower timing head.

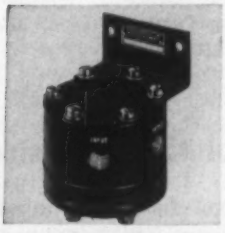
Model DED is available in two types. Type DED-11 has single-pole, double-throw contacts rated 15 amp, 115v, 60 c resistive load. Type DED-12 has double-pole, double-throw contacts rated 8 amp, 115v, 60 c resistive load. **A'G'A Div., Elastic Stop Nut Corp. of America,** Elizabeth, N. J.
—*Circle 464



Air Cylinders

Item 465

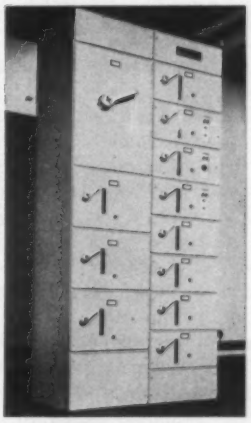
Device clamps, presses, opens and closes jigs and fixtures, operates valves. Stainless steel single and double-acting air cylinders are available in 1, 2 and 3-inch strokes, with 1-1/16 inch bores. Vinyl "U" cups are mounted in aluminum alloy piston which slides within the body. The front end of the body is fastened over the piston rod guide by rolling the front edge into a groove. Design is said to permit "throw-away" use. **Bimba Hdwe. & Mfg. Co.,** 101 Main St., Monee, Ill.
—*Circle 465



Selector Relay

Item 466

Suitable for use in pneumatic control circuits, instrument selects the higher of two input pressures and directs the higher pressure to the next element in the control circuit. Operation is with minimum friction and time delay. Model 58S is applicable for override control when one variable is normally being controlled. One or more other variables are tied in with the system through the high pressure selector relay. When any variables reach an abnormally high value, the output of its controller will increase above that of any of the other controllers. Through the selector relay, this secondary variable takes over operation of the control valve. Unit may also be used for monitoring. Maximum operating pressure is 100 psi, ambient temperature limits, −40 F to 180 F. **Moore Products Co.,** H & Lycoming Sts., Philadelphia 24, Pa.
—*Circle 466



Motor Controller

Item 467

Unit houses controls for 3-phase ac systems at 220v and 600v. All controls are centralized in one group of stationary, interchangeable enclosures, each with a grouping of modular starter units. Each structure has a main horizontal 3-phase bus lowered 12 inches from the top, and a 3-phase vertical bus for distribution of power to starter units.

Starters are the combination-magnetic type, consisting of a circuit protective device and a starter. Circuit protective device can be a Type AB air circuit breaker or a

*For Inquiry Card, see page 17

MODEL LF-1

POST DECITRON

Lineal Footage Counter

Connected to any Post DECITRON electronic counter, the lineal footage device provides accurate measurement of paper, wire, rope, sheeted products, etc.

If desired, a predetermined length can be "set" into a Post preset counter and when the lineal footage device reaches this length, a secondary circuit (i.e. a slitter or marker) can be activated.

Dependable, accurate, maintenance free. Varied "beam hole", or wheel size will permit fractional footage counting, if desired. Write for bulletin LF-1.

Decitron Electronics Products Division

POST

POST MACHINERY COMPANY

Beverly, Mass.

Circle 716 on Inquiry Card

MARKED IMPROVEMENTS in

IDENTIFICATION AND DECORATION

Now you see it, now you don't *... sometimes characterizes marking done on Markem machines. This isn't a problem of fading, or wear and tear (our "Ink Lab" takes particular pains to see to that). Rather, it's where the marking shouldn't show normally, or where it's used only during manufacturing. An example of the first is putting a trademark on eyeglass lenses, using our 70AB machine and special "breath image" ink which is, as you might expect, visible only when breathed upon. The second type of "now you see it" marking is illustrated by production control numbering of radio tubes with a Markem 45AG machine, instead of hand stamping them. Numbers are removed and replaced by a trademark imprint when tubes are completed. Thus even "temporary" marking, done the Markem way, can be useful.*

Seven come eleven, and other games *... like the sporting goods story told here previously, are all part of "industry's marking requirements." They also show how Markem sees the job through, from machine to final mark. Using a standard 25A machine, with special fixtures suggested by Markem, one manufacturer is now printing one side of 15 dice at a time. Compared to leaf stamping them individually, the Markem method has cut costs and boosted output tremendously — resulting in a second machine order. A similar business is running up their score, printing game tiles 132 at a crack with a special 25A. Whether your business is games, drugs, electronics, textiles, shoes or another field — your marking problems have answers at Markem.*

From Belgium to Brazil *... languages, customs and clothes may be different, but all share a common requirement for identification decoration marking. Take pharmaceutical houses: in Chicago, New York and other U. S. locations ... in Panama, Belgium, Brazil, Turkey and other spots around the world, Markem 45AE machines are imprinting batch and date codes on small cartons for drug items. Wherever your business is located, and whatever your marking needs, it may well pay you to see what Markem can offer. Ways to mark products, parts, packages — for decoration, identification or control — have been Markem's business for almost 50 years. Some good answers have been developed in that time — some that probably can help you.*

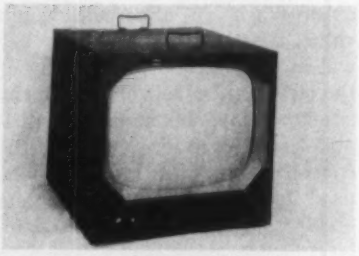
When writing, state size, shape, material of item to be marked; rate needed, color requirements, etc. Include sample if possible. This saves time, insures the right machine and method for your job. Markem Machine Co., Keene 37, N.H.

MARKEM

Circle 717 on Inquiry Card

fusible disconnect switch used in combination with a motor starter. Plug-in stabs are provided on the rear of each draw-out starter unit for power connection to the vertical bus. **Westinghouse Electric Corp.**, P.O. Box 2099, Pittsburgh 30, Pa.

—*Circle 467



Industrial TV System

Item 468

Video monitor has a dc restoration and a distortion correcting circuit. Model DVM-17 (shown) can handle input signals from 0.25 to 5v and sync signal in the same voltage range can be accepted separately.

Also in company's line is observer unit with a single video output equipped with resolution control. This arrangement supplies one volt of video signal and unit can resolve in excess of 600 lines. Automatic light compensator adjusts voltages to beam, target, and gain control points to prevent any change in picture quality even if the lighting varies by a factor of 150 times. **Blonder-Tongue Laboratories Inc.**, 9-25 Alling St., Newark 2, N. J.

—*Circle 468

Control Motor

Item 469

Unit designed to operate rotary. slipstem and butterfly valves, dampers and other final elements in automatic control systems. Motor is available in two basic models. Model M 630 is designed for two-position and floating control; Model M 930 is designed for proportioning control.

A gear train is incorporated for selection of timings from 7.5 seconds to 120 seconds, depending on model. Motors have a built-in internal brake capable of holding a dead-weight load up to 200 lb, preventing coasting in any of the positions. Adjustable limit switches control angle of rotation. **Industrial Div., Minneapolis-Honeywell Regulator Co.**, Wayne & Windrim Aves., Philadelphia, Pa.

—*Circle 469

Remote Valve Control

Item 470

Unit suitable for remote valve positioning, has upper and lower valve limit signals with meter indication of valve position. Controlled valve position is displayed on a 6-inch meter. Positive indication of upper or lower valve limits is made through color-coded segments at the extreme ends of the scale. Machine can operate with present motor controllers over any practical distance from a few feet to many miles. Two independent visual alarms are included for such functions as power failure, pressure, temperature or overload. **Sparton Controls System Div., Sparton Corp.**, Jackson, Mich.

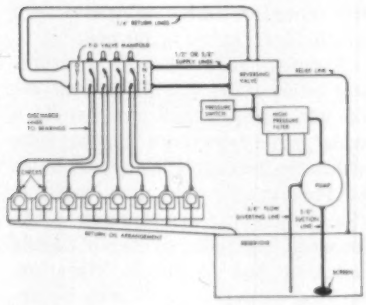
—*Circle 470

Circulating Oil System

Item 471

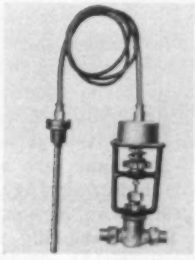
Suitable for the lubrication needs of presses, automatic and semi-automatic machine tools, two-line principle of operation supplies oil under pressure to measuring valves

*For Inquiry Card, see page 17



for delivery to bearing points. Valves have individual sight indicators and use positive piston displacement principle for feeding lubricant. A pressure sensing mechanism warns of clogged or broken lines in any part of the system.

Pumping unit allows a wide range of selection in the number of injections per minute applied to bearing points. Each valve is designed to serve two bearings, and external cross-porting accessory attachment can merge two discharge ports into one. **Farval Corp.**, 3249 E. 80th St., Cleveland 4, Ohio.
—*Circle 471



Temperature Regulators

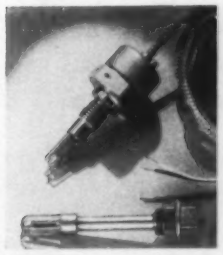
Item 472

Capable of automatic flow regulation of liquids or steam, regulators are of two types, direct acting and reverse acting. Direct acting regulator maintains liquid temperature by controlling the heating source. It is available in sizes ½-inch to 1½-inch. Reverse acting regulator maintains the liquid temperature by controlling the cooling source. It is available in sizes ½-inch to 1-inch. Both types are adjustable for temperature control within a 40F operating range within 100F and 240F. **Industrial Div., Watts Regulator Co.**, Lawrence, Mass.
—*Circle 472

Resistance Thermometers

Item 473

Suitable for temperature sensing in noncorrosive liquids and gases, resistance thermometers give fast thermal responses of less than 2.5 seconds in air and less than 50 milliseconds in water. Units are designed to operate over a temperature range from − 320F to 750F with an accuracy of better than ± 1 per cent of full scale and a repeatability of 0.2 per cent.



Resistance winding, which is supported on mica cards or cer-

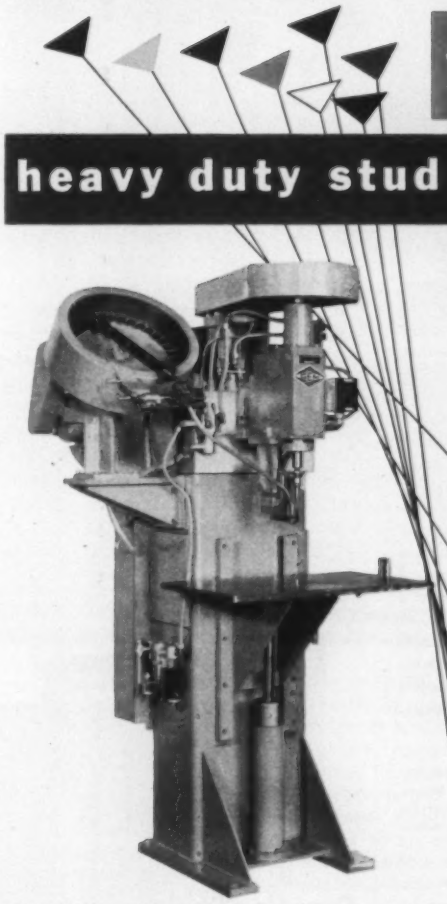
*For Inquiry Card, see page 17

speed up your stud setting

with GRAY

heavy duty stud driving

MACHINE



Model STD-1

This rugged, new machine can give up to 630 lbs. in. of driving torque, according to the motor used.

- Drives: standard studs up to ⅝ in. dia.; Schweppe self-tapping studs and Tap-Lok inserts
- Has screw-on or self-opening drivers
- Available with single or multiple spindles
- Up to 3 hp spindle drive
- Air-hydraulic spindle feed
- Up to 1000 cycles per hour
- Studs automatically hopper fed
- Easily retooled for other applications

Write for Bulletin STD-1 and suggestions for engineering this versatile machine to your work. Gray can do the whole job for you.

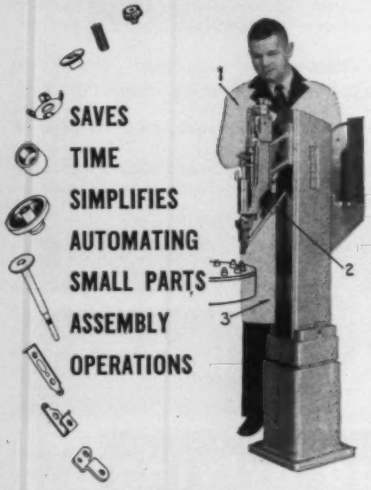
GRAY EQUIPMENT COMPANY

Automatic Assembly Equipment

13600 Ford Road • Dearborn, Michigan • Telephone: Tiffany 6-7573

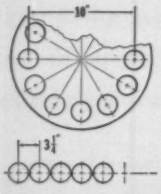
Circle 718 on Inquiry Card

New Standard DIXON Auto-Positioner



AUTOMATICALLY GUIDES PARTS OF 1/16" TO 3" O.D. SIZE AT RATES UP TO 6,000 PER HOUR

The new Dixon Auto-Positioner combines three standardized units—(1) Automatic Air-Operated Positioner, (2) Automatic Escapement, (3) Mounting Structure. Because the unit is compact and fits into small space, it provides an economical solution for a wide range of small parts assembly. It has an exclusive sensing feature that automatically stops your machines when parts are missing or malformed. Auto-Positioners are easily arranged at single or multiple stations with feeders, feed tracks, transfer or indexing tables. With properly tooled chucks, positioning punch, and proven feeder, parts are positioned at rates up to 6,000 pieces per hour. Individual units or any combination of standard components available from stock. Tooled Auto-Positioners provided to suit needs.



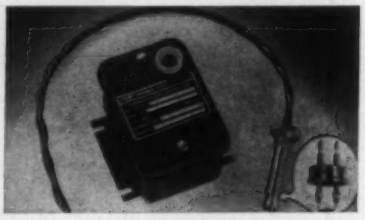
May be located at adjacent stations, only 3¼" apart for straight-line indexing, or on 12-station dial with a 5" fixture radius.

WRITE FOR FREE DATA SHEETS
New bulletins supply specifications and application data on standardized units now available from stock.

DIXON AUTOMATIC TOOL, Inc.
2312–23 rd AVENUE
ROCKFORD, ILLINOIS
Equipment for Automatic Parts Handling and Assembly

Circle 719 on Inquiry Card

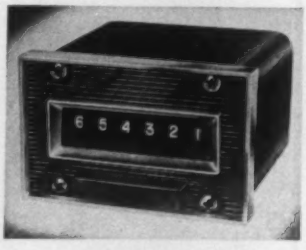
amic-insulated posts, is protected by a stainless steel cage. Mounting nut is machined to seat against a metal O-ring to provide a pressure-tight seal up to 1500 psia. Each instrument is furnished with teflon-covered leads protected with steel braid. Leads can be removed and external leads secured to the instrument terminals. **Trans-Sonics Inc.**, Burlington, Mass.
—*Circle 473



Level Sensing Unit

Item 474

Device operates in liquids from 75C to −55C or their pour points, whichever is the higher. Unit is capable of resisting shock, vibration and corrosion, has no moving parts and is ac or dc powered. Device can operate a light to indicate when the liquid is above or below the desired level, a control to start and stop pumps, or valves to transfer liquid from one tank to another. **Simmonds Aerocessories Inc.**, 105 White Plains Rd., Tarrytown, N. Y.
—*Circle 474

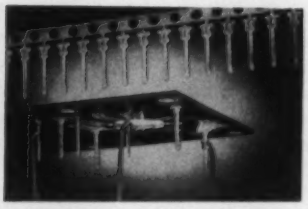


Counting Device

Item 475

Instrument is suitable for industrial and machine manufacturing industries where counting of articles moving at high speeds is required, or where timekeeping or the accurate measurement of rapid flow is necessary. Electromechanical counter adds, subtracts and totalizes at rates to 60 cps.

Totalizer operates with a counting pulse ratio of 50 per cent *on*, 50 per cent *off* and can handle a wide variety of pulse shapes, provided the leading edge of the pulse is reasonably steep. A bi-directional stepping mechanism locks between impulses, prevents double indexing due to shock, vibration, or over-voltage. Unit can be reset during operation without damage to the mechanism. A gear tooth design for the gear train minimizes backlash, allows precision indexing through six digits. **Autron Engineering**, 1254 W. Sixth St., Los Angeles, Calif.
—*Circle 475



Wire Wrap Terminals

Item 476

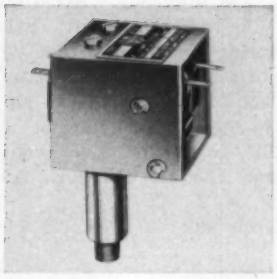
Device features a clinch-type design that holds the individual terminal firmly in the printed circuit board during additional assembly operations, until it is permanently soldered. Terminals are available in loose or chain form. When used in chain form and in conjunction with the Malcomatic lug inserter, automatic assembly of 20 wire wrap terminals into printed circuit boards in any pattern and at rates up to 20 boards per minute, is obtained. **Malco Tool & Mfg. Co.**, Dept. ANC, 4025 W. Lake St., Chicago 24, Ill.
—*Circle 476

Dual Pressure Switch

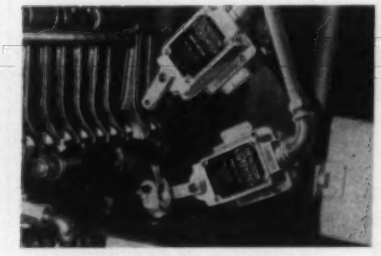
Item 477

Unit contains two separate switches that operate independently of each other for controlling two independent circuits. Pressure settings are individually made by adjustment screws located on top of the switch bracket. Switches can

For Inquiry Card, see page 17



be set together to simulate double-pole circuitry or set apart for independent operation. Model J75A is available in a variety of adjustable ranges between zero and 250 psi limits, and maximum pressures up to 350 psi. It is offered in the normally open, normally closed or double throw type with no neutral position. Switches are rated for 15 amps at 115 or 230v ac. **United Electric Controls Co.**, 79 School St., Watertown, Mass. —*Circle 477



Limit Switches

Item 478

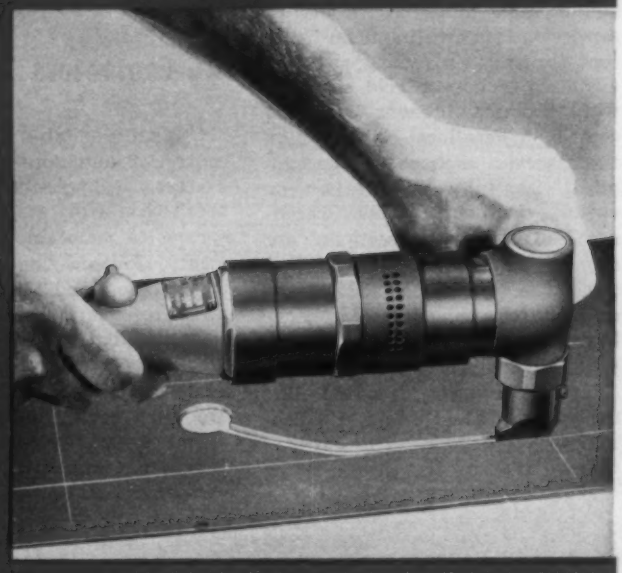
Heavy duty machine tool limit switch has two isolated circuits with overlapping contact arrangement. A spring return mechanism holds one circuit closed. Actuating the operating lever approximately 5 degrees closes both circuits; travel of an additional 4 degrees opens the first circuit while keeping the second circuit closed. The spring return reverses this procedure.

Switches are furnished for clockwise operation but direction may be reversed easily in the field. Safcty overtravel of 70 degrees in each direction is provided. Model L100WSO is enclosed in a water, dust and oil-tight case. **R. B. Denison Mfg. Co.**, 102 St. Clair Ave., Cleveland 13, Ohio. —*Circle 478

*For Inquiry Card, see page 17

he **HAD** to use a cutting torch

but **YOU** can use a Buckeye Air Tool!



Why AIR Tools?

Because air is everywhere, just waiting to be put to work . . . because continuous operation can't possibly harm an air tool . . . and because, if you're using Buckeye air tools, you can almost forget about tool maintenance.

Cutting irregular shapes in metal can be a very difficult job that requires a cutting torch, or at best, a whole series of drilled holes, plus some grinding and filing. On the other hand, you can clean up the job with neatness and dispatch by simply using a Buckeye air-powered nibbler. This tool makes a sharp, clean cut, free from distortion, in sheet metal, steel, plastics, etc. Starts anywhere on the workpiece, goes anywhere you want it to, even in corrugated material or tubing as small as 1 ½" diameter. Catalog A-10 tells all; write for your copy.

In Air Tools, Your Best Buy Is Buckeye

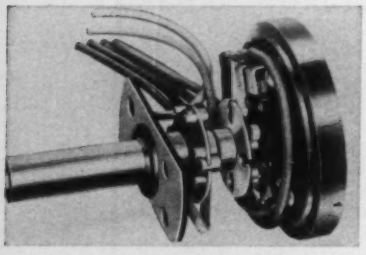
Buckeye Tools CORPORATION

DIVISION 12 • DAYTON 1, OHIO

Switchboard

Item 479

Unit can control services from 400 to 2000 amp. A variety of service sections with standard current transformer compartments is available in hot or cold sequence with a main breaker or main switch. Where local code permits, these service sections can be supplied with up to six breakers or switches without a main disconnect. Distribution sections are connected by a cable or horizontal bus. The bus is designed to permit future connection of switchboard sections as power needs expand. Switchboards can be fed by cable or bus duct. **Square D Co.**, 6060 Rivard St., Detroit 11, Mich.
—*Circle 479

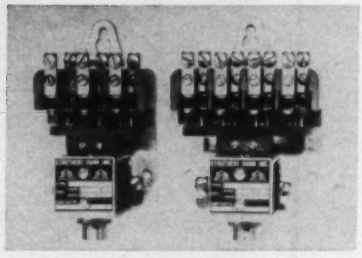


Speed Detector

Item 480

Unit is adaptable for use on conveyor and similar types of drives to indicate slippage or to actuate magnetic clutches. Many combinations of sensing switches to detect overspeed and underspeed in a narrow or wide range can be incorporated.

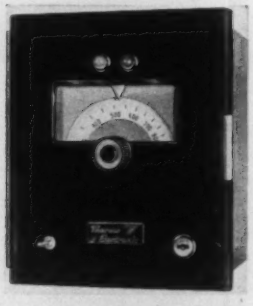
For use on diesel generators, it can disengage the starting mechanism when proper speed has been reached and protect the electrical and mechanical equipment against the dangers of overspeed. Detector is self contained, dust tight and can be flange mounted in any location. **Torq Engineered Products Inc.**, 32 W. Monroe St., Bedford, Ohio.
—*Circle 480



AC Contactors

Item 481

Units are suitable for use in the control of ac motors, solenoids and heaters. Single-throw, double-break contacts are individually-sprung to maintain contact alignment. Coil and contact terminals in the 3-pole and 4-pole contactors are accessible from the front for easy installation. Heavy mounting plates offer rigid support against torsional strain. Contacts are rated at 15 amp for standard ac voltages to 600 volts. **Struthers-Dunn Inc.**, Pitman, N. J.
—*Circle 481



Temperature Controller

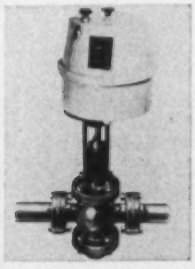
Item 482

Unit is adaptable for thermocouples or resistance bulbs. Use of transistors allows long life and durability of the instrument. Construction of unit enables it to withstand severe conditions of shock and vibration without loss of sensitivity and accuracy. Accuracy of the instrument's null balance measuring system is within ¼ per cent of scale span, and instrument will act on a temperature change of ½-degree F. Ranges from −320F to 3000F are available. **Thermo Electric Co. Inc.**, Saddle Brook, N. J.
—*Circle 482

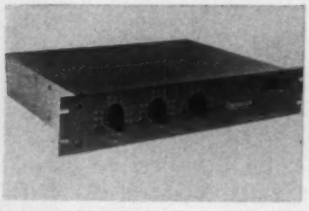
Valve Actuator

Item 483

Unit capable of control of flow, temperature, pressure, and other variables in closed or open-loop systems. Actuator can operate from signals supplied by controllers, remote positioning devices or directly from the measuring element. Model RF-697 operates directly from input signals of 1 to



5 or 4 to 8 ma dc. For ac signals, a rectifier mounted inside the actuator housing is supplied. The actuator can be mounted on any sliding-stem valve having from ½ to 1½-inch stroke and requiring less than 200 lb thrust. **Askania Regulator Co.**, 240 E. Ontario St., Chicago 11, Ill.
—*Circle 483



Digital Clock

Item 484

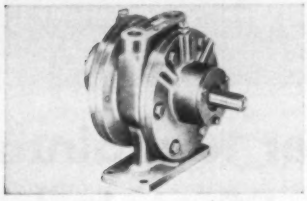
Unit designed to serve as a time source for data loggers, data handling systems, computers, digital

*For Inquiry Card, see page 17

time displays and other applications where a digital representation of time is needed. Clock can also be used as a twenty-four hour program controller, providing a contact closure for every minute of the day. Output of the digital clock has a non-ambiguous, parallel decimal contact closure pattern. Each digit position has an externally wired common lead for flexibility in operating both serial devices such as typewriters and tape punches, and parallel devices such as digital displays, from the same clock.

Output of the digital clock can also be used to initiate log cycles at periodic intervals, start and stop process equipment or start computational cycles. Power failure is indicated immediately on the front panel of the clock. Contacts are provided for remote indication of power failure. Time setting and adjustments are made by direct knob settings on the face of the digital clock. **Chrono-Log Corp.**, Dept. A, P. O. Box 4587, Philadelphia 31, Pa.

—*Circle 484



Air Motor

Item 485

Applicable on units such as pneumatic hoists or lifts, materials handling equipment, and for machine tool positioning and powering screw jacks, Model 6AM features reversible rotation. Any four-way operating valve built for pressures below 100 psi can be inserted in the air supply line for instantly reversible motor control. Variable speed ranges from 300 to 2000 rpm on air line pressures from 30 to 90 psi. Models with single rotation, right or left are alsa available. **Gast Mfg. Corp.**, Box 117N, Benton Harbor, Mich.

—*Circle 485

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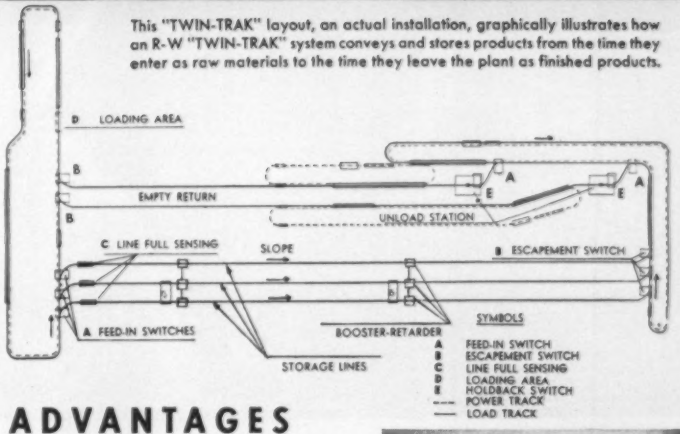
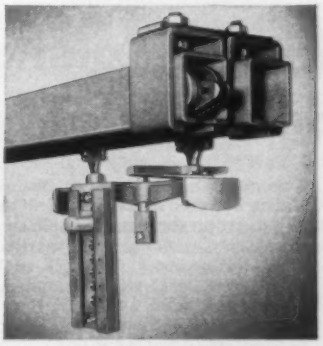
*For Inquiry Card, see page 17

This "TWIN-TRAK" layout, an actual installation, graphically illustrates how an R-W "TWIN-TRAK" system conveys and stores products from the time they enter as raw materials to the time they leave the plant as finished products.



ADVANTAGES

- **Provides trouble-free, automotive-selective control over product movement through entire plant.**
- **Economical and practical . . . provides added storage space . . . saves time, labor and money.**
- **Automatically supplies component parts to work stations from storage banks or lines.**
- **Economical to install . . . extremely flexible . . . quickly and economically revised or modified to meet your changing needs or future expansion plans.**
- **Ideal for conveying and dispatching products in multiple story buildings.**
- **Designed, manufactured and backed by the leading firm in this field for over 75 years.**



An R-W "TWIN-TRAK" System consists of one or more power tracks and as many storage or free tracks as desired. Available with efficient, economical manual or electronic selective controls designed to effectively meet your specific requirements.

WRITE TODAY

for complete information . . . request Catalog F-192.

Leading manufacturer of Track Hangers, all types of hardware and Electric Door Operators for over 75 years.

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MANUFACTURING COMPANY
Materials Handling Division

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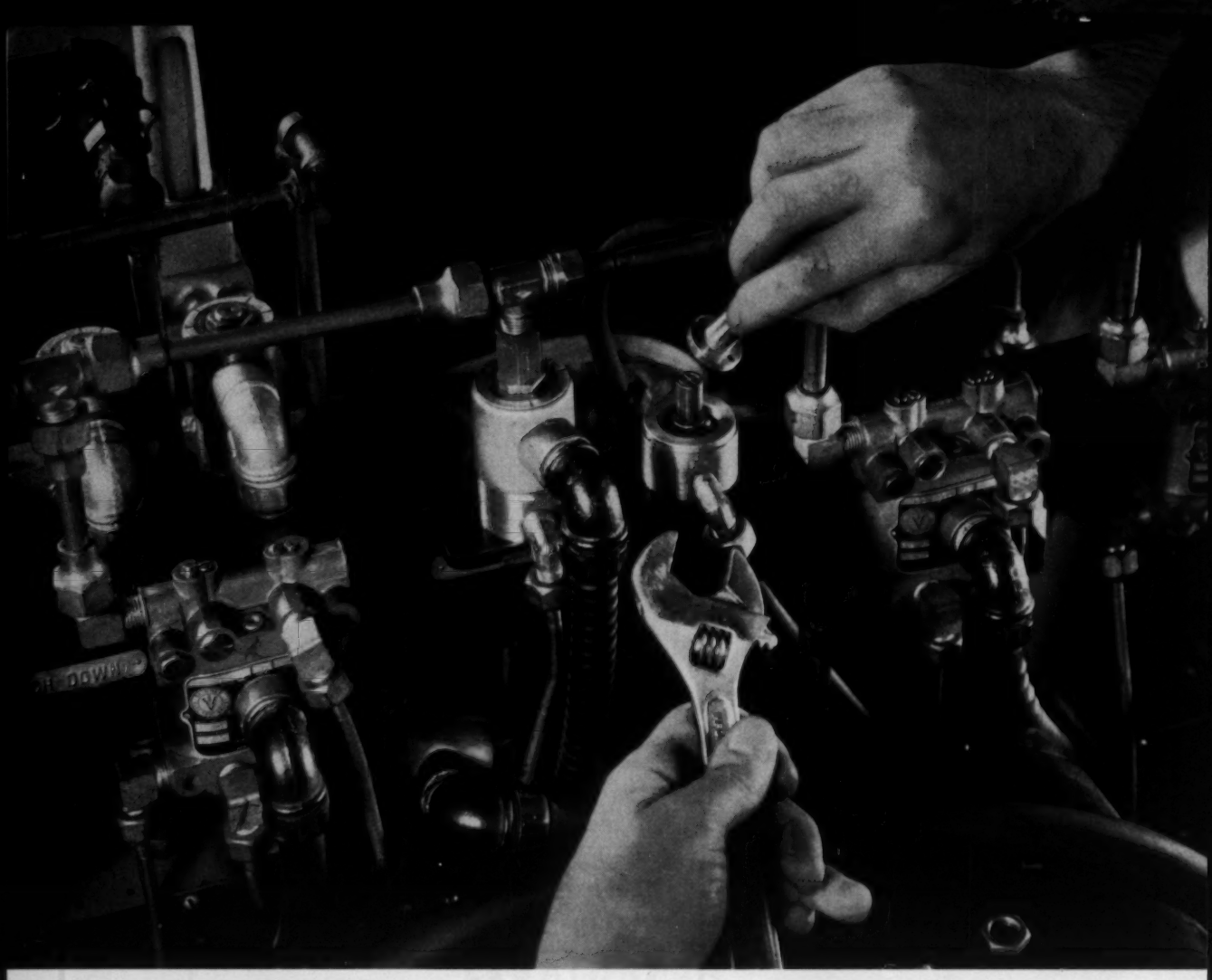

Skinner Solenoid Valves are easier to maintain and service because of their simplified design

The man shown above is cleaning a Skinner Solenoid Valve. He has disassembled it by hand without removing it from the line. Simplicity of design makes this simple maintenance and service feature possible. The design of Skinner valves is such that coils and other parts are interchangeable and easily, quickly replaced. They are readily available, too — reducing the stocking of spare parts to a minimum.

Skinner Solenoid Valves are made of the very finest materials available and contain only two moving parts. Their joints are heli-arc welded on special electronically controlled equipment. Their coils, manufactured to UL standards, will operate for years without burnout. Their positive spring returns eliminate sticking. And they have no packing to wear out and cause leakage.

If you are looking for solenoid valves that will give you longer trouble-free performance, look to Skinner valves. For complete information on Skinner's line of 2-, 3- and 4-way valves, write us or contact a Skinner representative. Write Dept. 320

Skinner Solenoid Valves are distributed nationally

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SKINNER ELECTRIC VALVE DIVISION

NEW BRITAIN CONNECTICUT

105 EDGEWOOD AVENUE

THE CREST OF QUALITY

catalogs and literature

Latest automation information. For copies use card page 17.

496. Roller Chains/Sprockets

Diamond Chain Co., Inc., Dept. 412, 402 *Kentucky Ave., Indianapolis* 7, *Ind.*—68 *page catalog*—Line of finished-bore and taper-bushed sprockets and roller chains is described in Catalog 757. Dimensions for sprockets, horsepower ratings for roller chains, a table for chain length calculation and list prices for various components are given. A section showing roller chain applications is included.—*Circle 496.

497. Stamping Machines

U. S. Tool Co., Inc., Ampere (East Orange), N. J.—16 *page booklet*—Data on multi-slide machines for the automatic production of precision formed stampings are given. Tooling specifications and illustrations of typical applications and auxiliary equipment are included in Bulletin 15.—*Circle 497.

498. All-Weather Motors

Industrial Motor Div., Robbins & Myers Inc., Springfield, O.—8-*page bulletin*—Features of Series 254-U rerated motors are illustrated and described in Bulletin 520. Motors have corrosion resistant steel housings with integral metal and cast iron parts also treated for corrosion resistance. —*Circle 498.

499. Saturable Reactors

Control Div., Magnetics Inc., Box 391, *Butler, Pa.*—32 *page handbook*—Applications for motor speed control, voltage regulation, and automatic battery charging are given. Typical application circuits, electrical characteristics and characteristic curves of control reactors are also covered in Catalog R-10.—*Circle 499.

500. Elevators and Conveyors

West Bend Equipment Corp., West Bend, Wis.—8 *page bulletin*—Automatic vertical and horizontal transportation for multiple-level conveyor systems and for between-floor production line handling is discussed in Bulletin E-557. Operating sequence for various systems and flow patterns for conveyor-lift installations are noted.—*Circle 500.

501. Miniature Air Devices

Clippard Instrument Laboratory Inc., 7390 *Colerain Rd., Cincinnati* 39, *Ohio*—8 *page bulletin*—Data is given on miniature air cylinders, valves, manifolds, and fittings for holding, ejecting, lifting, lowering, opening and closing operations. Also included are prices, fittings and accessories for these pneumatic devices.—*Circle 501.

502. Machining Units

Avery Div., Motch & Merryweather Machinery Co., Box 625, *Cincinnati* 1, *Ohio*—12 *page booklet*—Capabilities of machine units for drilling, reaming, spotfacing, boring and counterboring are explained in Bulletin 357. Major components of the units are described and typical dimensions and specifications are given.—*Circle 502.

503. Valves and Actuators

Pegasus Laboratories Inc., 3690 *Eleven Mile Rd., Berkley, Mich.*—12 *page booklet*—Collection of 4 technical bulletins describes servo-valves and ram actuators and gives specifications. Frequency response and flow rate curves are included.—*Circle 503.

504. Overhead Handling

Jervis B. Webb Co., 8951 *Alpine Ave., Detroit* 4, *Mich.*—8 *page bulletin* —Cranes and monorail systems for them are explained. Crane features and auxiliary equipment are described and illustrated. Also included is a section giving electrical features of the unit.—*Circle 504.

505. Hydraulic Accumulators

Industrial Hydraulics Div., Parker Appliance Co., 17325 *Euclid Ave., Cleveland* 12, *Ohio*—36 *page handbook*—Functions and applications of piston type models from 10 cu in. to 10 gal oil capacity are described and illustrated. Also included in Catalog 1530 are charts giving capacities at various pressures, drawings showing mounting methods, and a section covering care and maintenance.—*Circle 505..

506. Power Transmission

Ohio Gear Co., 1333 *E.* 179 *St., Cleveland, Ohio*—186 *page handbook* —Engineering charts, tables and formulas are given to help designers plan mechanical drives. Dimensions on standard spur, bevel, spiral, helical and worm gears are included. A section is devoted to mechanical information for selecting the proper speed reducer in relation to required ratios, horsepower, torque and installation dimensions.—*Circle 506.

507. Motors & Collector Rings

B. A. Wesche Electric Co., 9027 *Shell Rd., Cincinnati* 42, *Ohio*—8 *page bulletin*—Torque motors, special motors and collector rings for completing electric circuits between stationary and rotating parts are covered in Bulletin BAW-56. Data for collector rings and high torque motor applications are also given.—*Circle 507.

*For Inquiry Card, see page 17

508. Motor Controls

Allis-Chalmers Mfg. Co., Milwaukee 1, *Wis.*—12 *page bulletin*—Line of motor starters and contactors from 50 to 400 hp is described in Bulletin 14B8615. A section explains the ACBO arc centering blow out—an arrangement that utilizes the principles of thermal convection and magnetic action.—*Circle 508.

509. Airstream Conveyors

Dracco Corp., P. O. Box 1794, *Cleveland* 5, *Ohio*—32 *page handbook*—Data on pneumatic conveying for bulk materials handling problems are given in Bulletin 530. Types of airstream conveyors and their features are noted. Diagrams of typical installations are included, plus illustrations of various system components.—*Circle 509.

510. Clutches

Marquette Div., Curtiss-Wright Corp., 1145 *Galewood Dr., Cleveland* 10, *Ohio*—8 *page bulletin*—Over-running precision spring clutches available in ball bearing, sleeve and plain bearing styles, their advantages and features are covered. Methods of actuation are illustrated and typical installations described. Tables of dimensions are also given.—*Circle 510.

511. Small-Case Instruments

Fischer & Porter Co., 212 *Jacksonville Rd., Hatboro, Pa.*—16 *page booklet*—Line of small-case instruments suitable for indicating, transmitting and controlling pressure and temperature is covered in Bulletin 51-1450. Temperature measuring elements, bulbs and accessories, pressure transmitters and controllers are described. Charts giving pressure ranges are also included.—*Circle 511.

512. Mechanical Drive Parts

Jeffrey Mfg. Co., Columbus 16, *Ohio*—88 *page catalog*—Shaft collars, couplings, clutches, pillow blocks, gears, chains, sprocket wheels and related components for application on elevating and conveying machinery and in the industrial machinery field are described in Catalog 194. Dimensions and ratings for different parts and models are included.—*Circle 512.

513. Control Equipment

Powers Regulator Co., Skokie, Ill.—90 *page handbook*—Collection of bulletins describes temperature, pressure and humidity controls, diaphragm valves and air motors for industrial processes, heating, ventilating and air conditioning systems. Water and steam capacities for various valves are given. Drawings of typical applications of different parts are included.—*Circle 513.

514. Engineering Services

Associated Engineers Inc., 177 *Silver St., Agawam, Mass.*—8 *page bulletin*—Available engineering and manufacturing services from idea to finished product are noted. Functions of six basic company divisions are covered and the purpose of a special services division explained.—*Circle 514.

515. Plastic Forming Machines

Comet Industries, 9865 *Franklin Ave., Franklin Park, Ill.*—8 *page bulletin*—Automatic machines for sheet plastic forming and packaging are discussed. Features of dual station drape and vacuum forming machines are described, also machines for packaging small parts on continuous rolls of plastic. Illustrative examples of plastic vacuum formed parts are included.—*Circle 515.

516. Stepdown Transformers

Acme Electric Corp., Cuba, N. Y.—4 *page pamphlet*—Line of transformers to mount on manufacturing or processing machines and provide power for lighting, accessories or maintenance is described. Bulletin SD 311 lists stock sizes with specifications and dimensions.—*Circle 516.

517. Automatic Valves

A. W. Cash Valve Mfg. Corp., 666 *E. Wabash Ave., Decatur, Ill.*—12 *page booklet*—Pressure and temperature relief valves for water and industrial type pressure reducing and regulating valves for steam, water, air or oil are among models described in Bulletin P&H-57. Installation tips, construction features and specification tables are also given.—*Circle 517.

518. Installation Services

Commercial Contracting Corp., 12160 *Cloverdale, Detroit* 4, *Mich.*—16 *page booklet*—Services in industrial work are explained. Examples illustrating erection of presses, rolling mills, foundry machinery and overhead cranes are included.—*Circle 518.

519. Pressure Measurement

Consolidated Electrodynamics Corp., 300 *N. Sierra Madre Villa, Pasadena, Calif.*—4 *page pamphlet*—The Electromanometer, a device for pressure measurement is explained in Bulletin 1547A. Operating principles, readout methods, features and applications are given and specifications for the system noted.—*Circle 519.

520. Nutrunners/Screwdrivers

Chicago Pneumatic Tool Co., 6 *E.* 44th *St., New York* 17, *N. Y.*—Two booklets cover pneumatic screwdrivers and nutrunners with the Magnamatic one-shot clutch. Bulletins SP-3126-3 and SP-3165 illustrate various models and discuss the method of torque control, comparing it to other methods. Specifications and operating performance of the units are noted and applications to manufacturers assembly problems are cited.—*Circle 520.

521. Decimal-Binary Tables

Barnes Engineering Co., 30 *Commerce Rd., Stamford, Conn.*—2 *page pamphlet*—Pocket size pamphlet lists tables for converting from decimal to binary numbers and vice versa. Explanation of the system is given and instructions for using tables are also included.—*Circle 521.

522. Belt Conveyor Scale

Fairbanks, Morse & Co., Fairbanks Bldg., Chicago 5, *Ill.*—4-*page pamphlet*—Weighing materials in motion is possible with electronic belt conveyor scale described in Bulletin ED-12. Features of the weighbridge and the remote instrument and method of operation are covered.—*Circle 522.

523. Tracer Lathes

Cincinnati Lathe & Tool Co., Cincinnati 9, *Ohio*—8 *page bulletin*—Automatic operation of tracer lathes is explained, features and specifications given in Bulletin H-150. Standard equipment supplied for longitudinal step tracing and face tracing is noted.—*Circle 523.

524. Welding Positioners

Aronson Machine Co., Arcade, N. Y.—12 *page booklet*—Eight models with capacities from 5000 to 160,000 lb are described in Bulletin HTS 57. Data,

**For Inquiry Card, see page 17*

illustrations and detailed specifications for each model are given. Optional extras are also noted.—*Circle 524.

525. Data Processing

Electro Data Div., Burroughs Corp., 460 Sierra Madre Villa, Pasadena, Calif.—4 page pamphlet—Control of parts inventory is the subject of Bulletin 5-01-110. Application of the Datatron electronic system to the problem is explained, and a diagram of a system included.—*Circle 525.

526. Packaged Controls

Genetral Electric Co., Bloomington, Ill.—12 page booklet—Automatic controls for lathes, grinders, milling machines, conveyors, drilling machines, presses and packaging machines are described. Illustrations showing panels designed for such machines are included. Descriptions of various control components are also given.—*Circle 526.

527. Electric Motors

Reuland Electric Co., Howell, Mich.—8 page bulletin—General features of company motors for general use, machine tools, pumps, fans, etc. are described and illustrated. Motor types and optional equipment available include squirrel cage and slip-ring types, magnetic brakes, fluid couplings and gear reducers—*Circle 527.

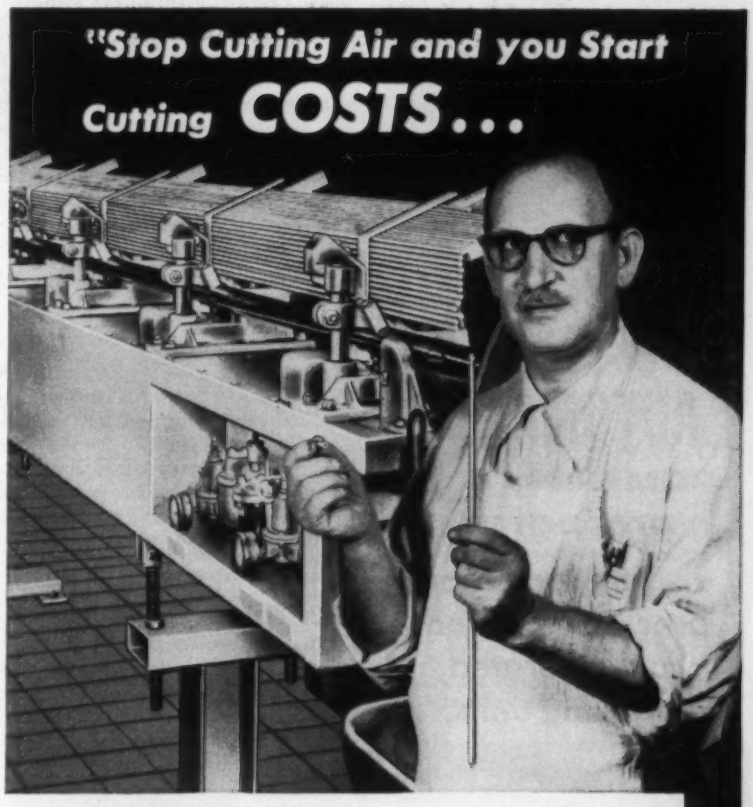
528. Hydraulic Equipment

Benjamin Lassman & Son, Route 8, Glenshaw, Pa.—12 page booklet—Design and manufacture of heavy duty high pressure hydraulic systems are discussed in Bulletin BL-757. Features of pump units, valves and cylinders used are also noted. Illustrative examples of special hydraulic systems are included.—*Circle 528.

529. Time Interval Meters

Beckman/Berkeley Div., Dept. 731, 2200 Wright Ave., Richmond, Calif.—9 page bulletin—Time interval meters are electronic counters that measure elapsed time between voltage changes. Their use for measurement of pulse width and elapsed time is explained in Bulletin 112. Applications for testing camera shutter speeds and measuring velocity with a time interval meter are noted and illustrated.—*Circle 529.

*For Inquiry Card, see page 17



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MAGAZINE LOADING BAR FEED"

Says Foreman Billy Smathers*

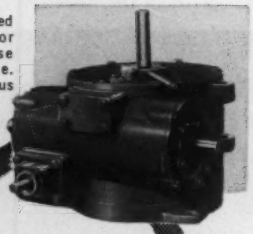
"We put in two Lipe AML Bar Feeds as a test," explains Foreman Smathers. "At the same cutting speeds as our other screw machines, the AML-fed machines turned out the two pieces I hold in my hands, 78% faster for the small ⅞" piece, and 108% faster for the 16" piece. That opened our eyes . . . but quick! Yet the reasons were perfectly obvious. The Lipe AML's fed stock without pausing. No cutting air. No repeat motion for feed-outs. No down-time for changing feed fingers, or for remnant disposal. The AML's geared our production to the steady pace of the clock . . . so many units of output per so many units of time. Overall, the gain was astonishing!"

WRITE OR WIRE for a FREE Lipe Sales Engineering estimate of production increases, savings and amortization time of Lipe AML Bar Feeds in your production layout.

* Photographer's models and pseudonyms used to protect company identity and confidential information.

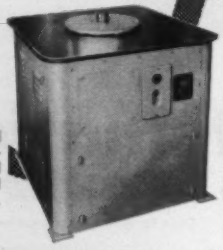
Lipe-ROLLWAY CORPORATION SYRACUSE 1, N. Y.

Machine Tools • Heavy-Duty Automotive Clutches • Portable Power Hack Saws

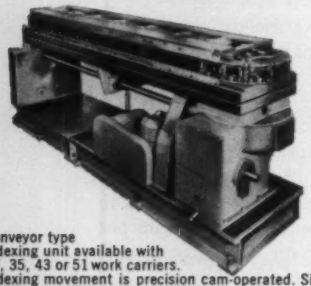


Basic cam-operated indexing unit for special purpose machine drive. Available in various sizes.

The basic units for AUTOMATIC assembly or production ...Standard Tool precision, proved cam-operated indexing units.



Basic cam-operated indexing unit incorporated in standard table with mechanical locking arrangement, timer and drive.



Conveyor type indexing unit available with 27, 35, 43 or 51 work carriers. Indexing movement is precision cam-operated. Side and top machine surfaces allow for ease of tool mounting. Furnished complete with drive.

1. *Reduces design time.*
2. *Permits rapid re-tooling when necessary.*
3. *Wide range of sizes and indexing increments.*

Standard Tool indexing units provide smooth, accurate positioning between automatic production stations. They are built for heavy duty operation and furnish the basic requirement for profitable automation. Engineers at Standard Tool are skilled in manufacture of completely automatic assembly and production machinery into which these indexing units are incorporated. Your inquiries will receive prompt, competent acknowledgement.

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Creative Machine Designers and Builders Since 1910 » » « «

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530. Controlled Volume Pumps

Milton Roy Co., 1300 *E. Mermaid Lane, Philadelphia* 18, *Pa.*—16 *page booklet*—Data on controlled volume pumping systems are given. Bulletin 457 discusses uses for corrosion control, product inhibitors and additives, water treating and pH control. Included are numerous illustrations and schematic drawings and a section describing company's equipment.—*Circle 530.

531. Press Feeders

H. E. Dickerman Mfg. Co., 321 *Albany St., Springfield, Mass.*—8 *page bulletin*—Operating principles of Rol-Di-Feeds are explained. Features of the units are described and specifications given. Illustrative examples of typical applications are also included. —*Circle 531.

532. Vibratory Feeders

Vibratory Feeder Co., Div. Automation Devices Inc., Erie, Pa.—10 *page bulletin*—Base units, blank bowls and supply hoppers are described in Catalog 5742. Prices, dimensions and features of various models are noted.—*Circle 532.

533. Coiled Cords

Cords Limited Div., Essex Wire Corp., 121 *Dodge Ave., DeKalb, Ill.*—16 *page booklet*—Characteristics, features and applications of the cords are described. A section explains wire types and constructions available for them. Also included are data and outline dimensions for numerous rubber and thermoplastic plugs and connectors that can be molded on the cords.—*Circle 533.

534. Forming Metal

Grotnes Machine Works, 5454 *N. Wolcott Ave., Chicago* 40, *Ill.*—8 *page bulletin*—General view of company's method of forming metal without machining, heat or destruction of the metal is given. Equipment used for expanding, shrinking and rolling operations is described in Bulletin 555. Illustrative examples of the integration sequences are also noted.—*Circle 534.

535. Electric Brakes

Star-Kimble Industrial Motor Div., Safety Industries Inc., P. O. Box 904, *Hamden, Conn.*—8 *page bulletin*—Design, operation and construction features of company's electric disk brake line are explained in Bulletin SK-4896. Various components of the unit are illustrated and a chart listing the torque ratings is included.—*Circle 535.

536. Resistance Welders

Taylor-Winfield Corp., Warren, Ohio—8 *page bulletin*—Line of resistance welding machines is described. Bulletin 8-413 covers end products, type of operation, production rate and associated materials handling equipment for each machine.—*Circle 536.

537. Control Devices

Controls Co. of America, Schiller Park, Ill.—24 *page handbook*—Various types of control units designed by company are described and illustrated. Applications of these units in home and industry and company facilities to produce them are shown. —*Circle 537.

538. Pneumatic Handling

Brady Conveyors Corp., 4244 *Dempster St., Skokie, Ill.*—8 *page bulletin* —Data on the system and principle of operation for transporting dry pulverized and granular materials are covered. Schematic drawings on applications of the system and a description of various components are included. Illustrative examples of installations are given.—*Circle 538.

539. Engineering Services

Teller Co., Butler, Pa.—12 *page booklet*—Engineering services such as designing automatic conveying and production systems or developing and improving automatic controls are discussed. Case histories of problems and patterns for solving them are given.—*Circle 539.

540. Electronic Longhand

TelAutograph Corp., 8700 *Bellanca Ave., Los Angeles* 45, *Calif.*—16 *page booklet*—Device which delivers handwritten messages electronically is described. Features and applications of the electronic pen are noted and illustrations of the system's equipment included.—*Circle 540.

541. Liquid Chemical Feeder

Clarkson Co., Div. Equipment Engineers Inc., 564 *Market St., San*

*For Inquiry Card, see page 17

Francisco 4, Calif.—4 page pamphlet —Construction materials, drive and capacity of precision liquid feeders are given. Illustrative examples of the unit at work are included in Bulletin 575.—*Circle 541.

542. Volumetric Feeding

Omega Machine Co., 345 Harris Ave., Providence 1, R. I.—4 page pamphlet — Continuous volumetric feeding of liquids and slurries is subject of Bulletin 65-H12B. Principle of operation and various components of the unit are described. Also included are dimensioned drawings of the feeder.—*Circle 542.

543. Car Unloading System

Sprout, Waldron & Co. Inc., Muncy, Pa.—4 page pamphlet—Vacuum conveyor system for unloading cars of dry, pulverized and granular materials is covered in Bulletin 174. Use of light-weight flexible hose for unloading from unusual locations is discussed.—*Circle 543.

544. Adjustable Bed Presses

Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y. —4 page pamphlet—Re-designed adjustable bed presses for operation with automated lines are described in Bulletin 60E Supplement 2. Illustrations explaining the operator's panel, automatic circulating oil system, air control panel and press control panel are included.—*Circle 544.

545. Overhead Handling

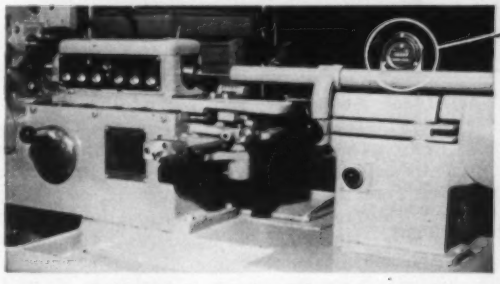
Whiting Corp., 157th St. & Lathrop Ave., Harvey, Ill.—12 page booklet— Ideas for utilizing overhead space in production, shipping, receiving, warehousing and storage are given in Bulletin M-32. Illustrative examples of typical applications are also shown. —*Circle 545.

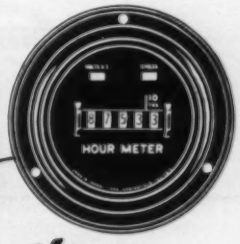
546. Pneumatic Drive Units

Copes-Vulcan Div., Blaw-Knox Co., Erie, Pa. —4 -page pamphlet — Pneumatic power drive units for the remote operation and positioning of valves, dampers, louvers, rheostats, vanes and variable-speed drives are discussed in Bulletin 1033. Principle of operation is explained and a table listing sizes, torque ratings and weights is included—*Circle 546.

*For Inquiry Card, see page 17

AUTOMATION REQUIRES GREATER EMPHASIS ON PROTECTIVE MAINTENANCE





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The Hobbs AC Hour Meter indicates operating time of any machine or equipment powered by alternating current — basic time data essential in the study of utilization and production methods . . . and vital for protective maintenance programs. Wide range of applications — small, compact, easy to install. Ruggedly built and sealed against moisture and dust. Powered by an accurate synchronous motor specially designed for this instrument. Easy to read — tells at a glance accumulated time of operation to 10,000 hours, showing 1/10th hours. Also available in 100,000 hour models.

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JOHN W. Hobbs CORPORATION — A DIVISION OF STEWART SW WARNER
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Another new series!

Series "K" medium-duty UNIBILT belt conveyors

Available in a variety of standard belt widths drives speeds and models.

customer-assembled conveyors and systems from a complete line of standard slider and roller components

We manufacture a complete line of UNITIZED design belt, chain, live roll and gravity roller conveyor equipment.

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CONVEYOR SPECIALTY COMPANY, INC.
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AUTOMATION • problem forum

Readers with problems concerning systems, equipment or components for automated operations are invited to outline them to: The Editor, AUTOMATION, Penton Bldg., Cleveland 13, Ohio. Solution suggestions should refer to case number and title of the problem involved.

Case 1314-P
Components For Gaging

. . . We have lately entered the field of automatic gaging. We thus contemplate using in the future: Shaft position encoders, card or tape translators, position transducers, analog-digital converters, arithmetic units and digital display units or printers. May we ask you, therefore, to put us in contact with competent manufacturers or their sales outlets in order to further discuss with them the requirements?. . .

Chief Engineer

• • •

Case 1277-P
Powder Moisture Control

. . . We should like to locate an instrument which could continuously sense a stream of free flowing powder and indicate (and/or control) the moisture content of this stream. The range of moisture encountered is from 0 to 5 per cent. . . .

Plant Superintendent

• • •

Case 1315-P
Furniture Making

. . . We would very much appreciate it if you would be kind and enter the following under the Problem Forum: We want to learn more about interior transportation, machinery and laborsaving methods in the production of beds and upholstered furniture. . . .

Furniture Manufacturer
Sweden

• • •

Case 1316-P
Garment Packing

. . . Would you please refer us through your Problem Forum to manufacturers of packaging equipment that might be interested in the following problem. To design, if necessary, and manufacture a machine that would: (1) eject a preformed-collapsed box from a magazine, (2) print content information on the box, (3) erect the box, (4) place tissue in the box, (5) load the box with garments, (6) fold over the tissue and, (7) erect and place top on box. We presently feel that the ability to individually print boxes as the various styles and sizes come off the line is a necessary requirement. A progressive type mechanism is envisioned for this service with an output of 20 to 30 boxes per minute. . . .

Research Engineer

• • •

Case 1275-P
Rotary Switch

. . . We are endeavoring to contact a manufacturer of a rotary switch having 2 poles and up to 50 ways. The switch would be capable of rotating at up to 1000 rpm. We hope that you will be able to put us in touch with such a manufacturer. . .

Senior Engineer

• • •

Suggestions For 1254-P
Hopper Level Control

. . . We are enclosing complete specifications and prices on the various model material level indicators which we manufacture. These Bin-Dicators are basically designed for use with dry, bulk materials. . . .

George A. Schemm
Bin-Dicator Co.

•

. . . We are enclosing two prints showing upper and lower switches which will control level of dry powdered or granular material in a hopper. The upper paddle switch will shut off any equipment which is being used to fill the hopper. The low level switch will start the equipment. . . .

Lewis Ulrich
Hartley Controls Corp.

•

. . . The photoelectric control manufactured by us will readily solve this problem. In brief, if the transmitter and receiver are so mounted as to pick up reflected light at the correct height of the clay, the screw conveyor can be automatically stopped. . . .

Charles Zauderer
Mason Instrument Co.

•

. . . Enclosed please find a copy of our latest Catalog 57 and you will find a new Lucite rod bin level control listed on page S20. . . .

Werner A. Gieseke
Autotron Inc.

•

. . . We manufacture the Cash Standard Series 100 positioning type controllers that can be pneumatically or hydraulically operated to bring accurate level controls for powdered clay that is being fed to a hopper. . . .

P. G. Boden
A. W. Cash Co.

• • •

Suggestions For 1017-P
Pneumatic Sand Conveying

. . . It is possible that Dracco Airstream conveying equipment could be recommended for the requirement that one of your readers outlined for handling of prepared molding sand in an iron foundry. . . .

H. W. Gaeckle
Dracco Corp.

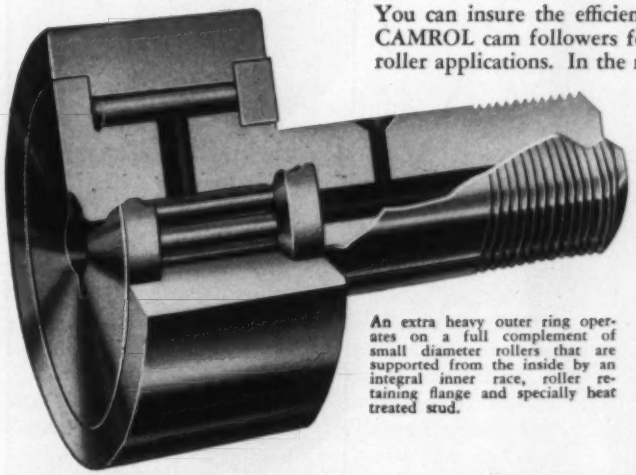
•

. . . The problem as quoted is too general and unspecific to warrant us in saying that we can or cannot handle this problem. We will be glad to study his conveying application and give our recommendations in the event that our type of equipment is suitable. To determine this we will need data on: The sand; how and from what it will come to our system; the rate at which it must be conveyed—or, if it comes to us in batches—their size, weight and frequency; number of receiving points, and the distance involved. . . .

E. C. McDowell
Robinson Air-Activated Conveyor Systems

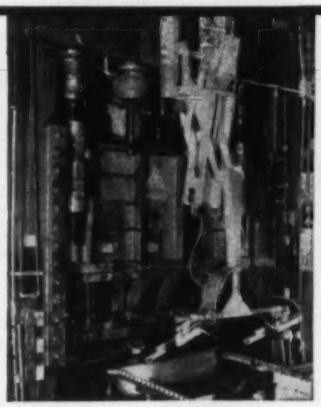
AUTOMATION TIPS by McGill

Insist on CAMROL® bearing advantages when planning your automation



An extra heavy outer ring operates on a full complement of small diameter rollers that are supported from the inside by an integral inner race, roller retaining flange and specially heat treated stud.

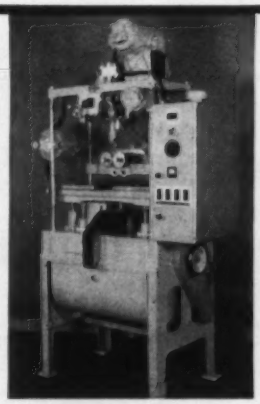
You can insure the efficiency of your automated production by specifying CAMROL cam followers for cam action, track roller or guide and support roller applications. In the machinery you specify or in your own automated operations, CAMROL bearing quality guarantees dependability and longer bearing life. Their ability to withstand intermittent shock and heavy radial loads, space economy, ease of installation, simplified lubrication and balanced hardness and toughness recommends CAMROL cam followers for the critical antifriction requirements of automation. You can eliminate downtime due to premature failures of improvised units or ordinary bearings. Insist on CAMROL CF or CYR (without stud) bearings. Both types are available in a wide range of standard sizes as are the sealed SCF and SCYR series.



Camrol bearings eliminate bearing trouble for Sahlin iron hand unloaders.

Sealed CAMROL SCF bearings on the upper arm assembly travel a confined can track to provide direction and support fo the unloading arm. Here the IRON HAND machine is shown removing 12(lb. bathtub blanks from a forming pres onto a conveyor for additional automati operations. The Sahlin Engineering Co. Inc. that supplies this unique press unloader to automate press operations adopting CAMROL cam followers, ha virtually eliminated bearing replacement under all conditions.

SEND FOR CATALOG 52-A



Camrol bearings show no apparent wear after three years use in automatic packaging machines.

The Kartridg-Pak Machine Co. uses McGill CAMROL bearings in the main drive mechanism of a packaging machine that also forms the container from thermoplastic film. This machine automatically forms, fills and closes 1800 packages of food or other semi-fluid products per hour. Dependability and accuracy of the free rolling and easily lubricated cam followers help guarantee the efficiency of these automatic operations.

After three years of use in this application, the CAMROL bearings show no apparent wear.

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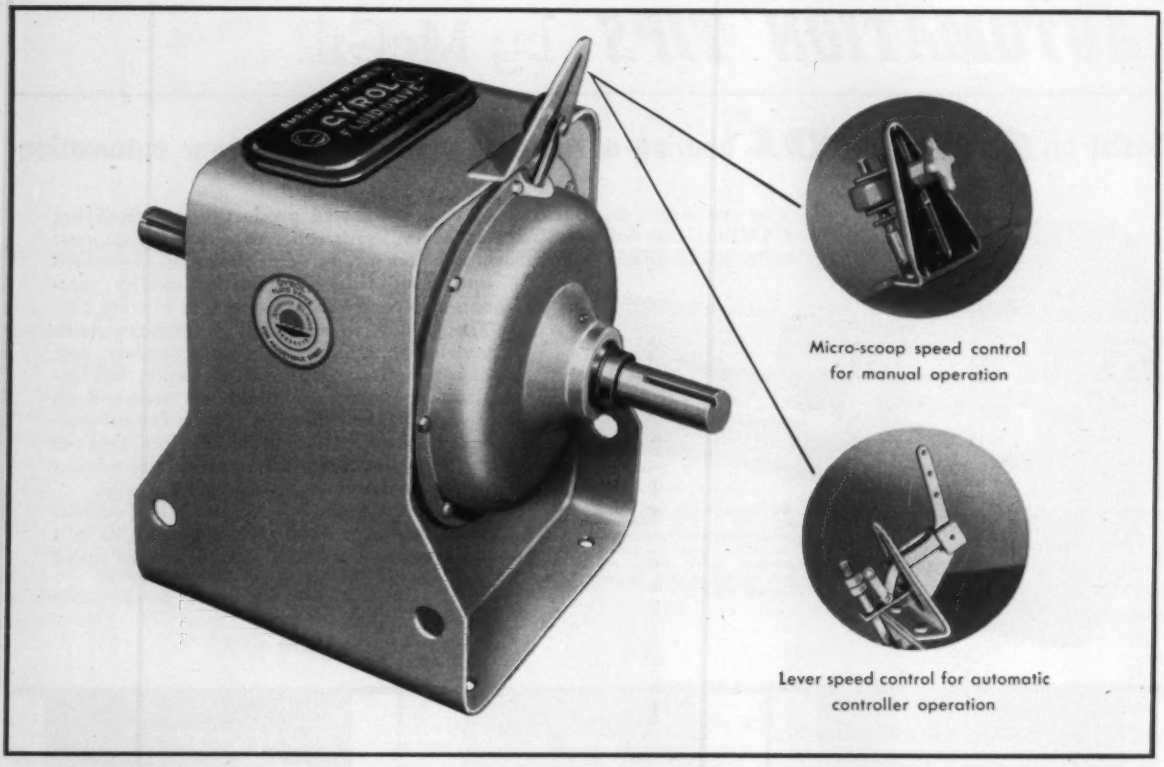

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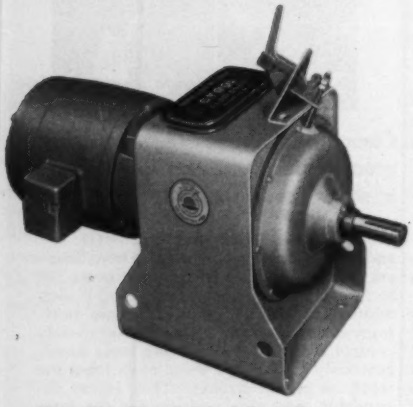

Type VS, Class 2 Gýrol Fluid Drives for 1- to 25-hp applications. Also available with flange-mounted motor, as shown.

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AUTOMATION abstracts

DESIGNING PRODUCTION MACHINES

By ROBERT F. BREWER and JAMES A. HOSFORD
Western Electric Co.
Allentown, Pa.

CONFRONTED with one of the complex high-speed automatic machines that are increasingly necessary to maintain the pace of modern production, the layman may conceive it to be the brainchild of a single inventive genius. Engineers know that rarely if ever is this the case. Most of today's production machines represent years of evolution and embody the contribution of many minds. Over a period of decades perhaps, the addition of new features or the modification or refinement of existing ones have advanced the usefulness of such equipment and brought them to their present state.

But the pace of technological progress does not always allow for a leisurely process of evolution. Today, more and more frequently manufacturing engineers are confronted with the need to develop radically new techniques to make products for which there may be few if any production precedents—to "start from scratch," so to speak. Such a problem confronted Western Electric Co. engineers assigned responsibility for tooling to produce the glass-enclosed dry reed type switches, *Fig.* 1, for application in various switching systems. At the outset of this undertaking it was apparent that they would have to develop new machinery capable of high-speed low-cost production if the switch and the operating economies it promised were to be made available at all. For W. E. engineers—who are challenged to match the tremendous research capacity and creativity of Bell Telephone Laboratories with appropriate production techniques—this pivotal role with respect to translating new laboratory concepts into service-ready products is becoming an increasingly familiar one. More and more they are called on to develop production processes as original in concept as the product itself.

Planned Approach

There is, of course, no effective substitute for a carefully planned attack on problems of this sort, involving as they do so many complex interrelated considerations, so many untried approaches. The stakes are too high to permit an offhand approach; the costs of a series of abortive attempts—even though eventually crowned with success—would be prohibitive, defeating thereby the objective for which the project was started in the first place.

Some industries "farm out" the problem, calling on the services of design and construction firms specializing in automatic machinery. If, however, the product is difficult to manufacture and has special end requirements not likely to be fully appreciated by the outsider, this course may prove both expensive and, from the point of view of results, un-

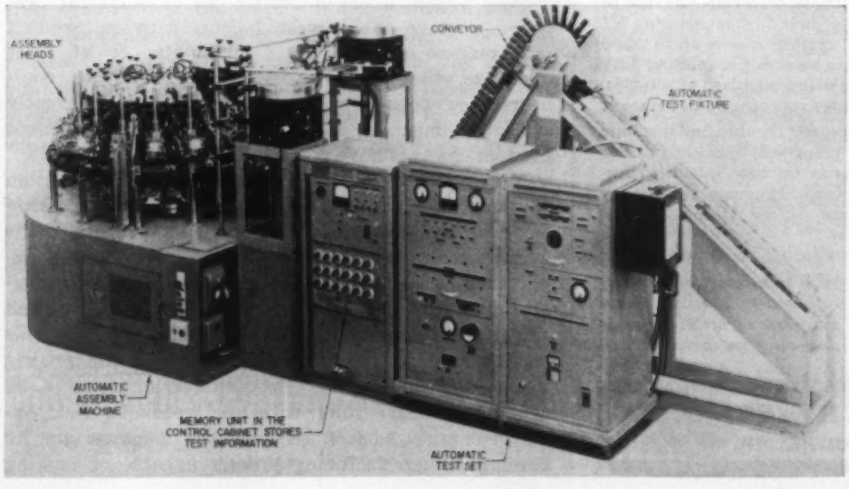

Fig. 1—Automatic production machine for dry reed telephone switches positions reeds, fills glass envelopes with gas, seals ends, and checks operating characteristics of finished switches. Feedback circuit in test section automatically readjusts reed spacing on subsequent switches if performance does not meet specifications.

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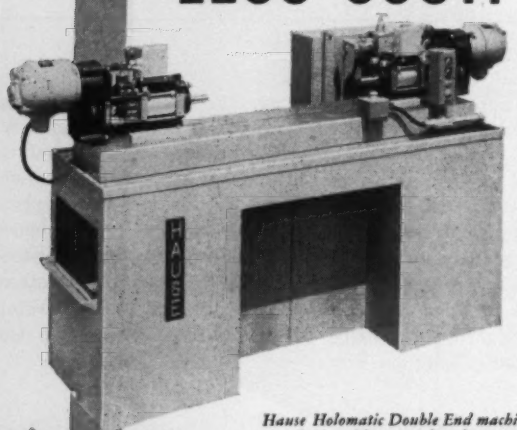

Hause Holomatic Double End machine. Available with manual cycle or automatic—interlocked control systems.

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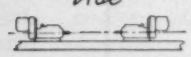
Methods of Use



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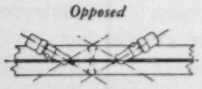

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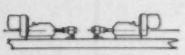
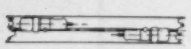


With External Tool Supports for Boring



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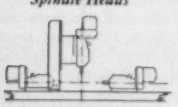

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satisfactory. In the long run, then, it appears best to assign development of the specialized machinery required for a new product to the manufacturing engineers responsible for its production, who possess thereby a full understanding of product requirements. Experience indicates that for effective results the manufacturing development engineer should have responsibility for co-ordinating all aspects of his project; not only for the development program as such, but also for the vital period of proving-in his newly developed machine under routine manufacturing conditions.

Of initial importance to such a project is, of course, the selection of an effective engineering team. If success is to be achieved, each individual on that team must be chosen not only for the technical proficiency he can contribute but also for his ability to work effectively with others. He must be possessed, too, of a native curiosity about what makes things "tick" and a disposition to be dissatisfied with any element of the job that does not meet his exacting standards.

Obviously, economic considerations govern the manufacturing development project from start to finish, determine whether it should be undertaken in the first place, provide a measure of its eventual success. The engineering team, then, must at the very outset undertake a thorough economic study of their proposed venture. The projected unit cost of the product involved will define the economic limits within which the team must work.

Make or Buy

Since commercial machinery can almost certainly be purchased for less than it would cost to design, construct, and prove in similar specialized machinery, the engineering team must first determine whether the market offers facilities which, with appropriate modifications, might meet the service and cost objectives of the project. If—as is more and more frequently the case—commercial machinery is not adaptable to the task at hand, the development of specialized facilities must proceed with those same cost and service objectives constantly uppermost in the minds of the designers. They must take into account, too, the probability of radical product and process design changes during the development program. Only the closest liaison between product and process engineers can eliminate, or at least minimize, the discouragement manufacturing engineers face when they have developed an apparently successful machine only to discover that subsequent product changes have made it obsolete.

It is only on the basis of a thorough exploration of these and other factors that the manufacturing engineer can undertake to "sell" his project to his management. Nor should he underestimate the importance of such selling; it is a part of his responsibility not only to his employer but also to himself and the advancement of his profession. To this end as well as to the advancement of the project itself, each member of the engineering team must acquaint himself fully with the product's field requirements. And it becomes the common aim to develop a manufacturing process capable of making

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a product well within the service and cost specifications that field requirements impose. In the case of the dry reed switch, for example, it was recognized at an early stage that cost objectives could be met only by employing sampling inspection for visual requirements such as contact cleanliness and alignment. This realization had a strong bearing on subsequent planning.

The closest liaison with design development engineers is of particular importance to manufacturing engineers developing highly mechanized or automated processes. In such processes the cost of materials and piece parts is a major element of the unit cost. Working together, development engineers and process engineers may achieve design improvements which materially reduce that cost.

When the design is considered reasonably stable, manufacturing engineers proceed to a detailed analysis to determine exactly what their projected machine must do, what individual operations it must perform, what machine functions will be required to fulfill them and in what sequence. Such an analysis will help them decide what elements in the process require simplification, which operations can appropriately be combined with others. In the automatic switch assembly machine the gas-filling, glass-sealing and reed-spacing operations could be successfully combined.

Preliminary Layout

A preliminary layout or sketch outlining each desired machine function is a useful aid at this point. Here the engineer and his associates call upon all their pooled knowledge of mechanical movements, power supplies, electrical and mechanical controls, of sensing, memory and motivating mechanisms. They tabulate each machine function in order, noting the type of motivation required—cam drives, pneumatics, solenoids, etc. They concern themselves at this point only with basic machine functions, make no attempt to integrate them in a single machine.

The general form the machine will take emerges from continuing study and discussion by the engineering team. Should the machine take the form of a circular table? Or should it be an in-line type? Should it move continuously? Or should it be an indexing machine? In this determination the engineers must necessarily take into account every operation their analysis reveals as essential. But no element is more important to their final decision than the requirements imposed by the product itself. In the case of the dry reed switch, it was decided to build the assembly machine around a continuously revolving turret, circumventing thereby the problems of acceleration and deceleration associated with an indexing machine which might shift the reeds during the sealing process and thus affect the characteristics of the switch.

The engineers may now make a layout of the entire machine. This layout represents a summary of all findings to date. Several alternate methods of performing the same operation may be indicated until a conclusion is reached as to the most satisfactory mechanism from the point of view of com-

patibility with other required operations and of product performance.

Should the layout call for mechanisms incorporating untried principles, working models of each should be built and tried before detailed design of the prototype machine is undertaken. For the dry reed switch project, brass models of the parts-feeding mechanisms and chucks were built to check design principles.

Next comes a stage of reassessment and appraisal. Here it is most useful to discuss plans and problems with fellow engineers and supervisors. No source should be neglected. Sales representatives of the suppliers of specialized machinery may provide useful tips; advice from shop supervisors, machine setters, engineering service organizations and product design people may prove invaluable. For example, the design of one of the reed chucks in the dry reed switch machine was a toolmaker's idea. The addition of a magnetic field to improve switch contact alignment was suggested by a Laboratories engineer.

Now begins the phase of development work calling for the greatest ingenuity and creativity on the part of the engineering team. Product and process must now be made completely compatible. Machine mechanisms must be combined, simplified, condensed—made thoroughly workable. At this stage minor product redesign may be suggested if it becomes apparent that one or more operations can be eliminated or others combined without compromising product requirements. Optimum machine motions can be determined by utilizing work simplification and motion economy principles. Timing diagrams can prove helpful in correlating all the machine's functions. At the conclusion of these studies, a layout of the entire machine is prepared and detailed drawings made.

During construction of the prototype the manufacturing development engineer works closely with the men who build the machine. And he stays close to the machine during its prove-in period. It took, for example, about six months experience with a one-head dry reed switch assembly machine before various proposed switch designs could be fabricated.

Performance Testing

To measure the performance and efficiency of the new machine, process and machine capability charts are an effective yardstick. The objective, of course, is a machine which will produce at a uniform high quality level. Variables, then, should be introduced only in the context of a statistically controlled experiment, to determine the effect of the variables under study. Evaluation of these effects can be accomplished by careful observation, the use of quality control charts and by analysis of variance.

Correlation studies may be necessary to determine the degree of variability. These studies often reveal critical problems which must be answered before design of the final machine is undertaken. For example, dry reed switches produced on the prototype machine showed a wide spread of electrical characteristics. Obviously some element of the process was not under complete control. But which one? Visual examinations failed to detect the source of

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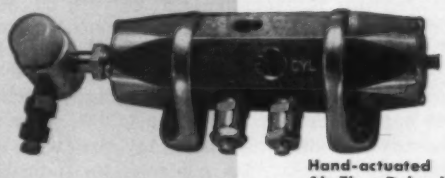

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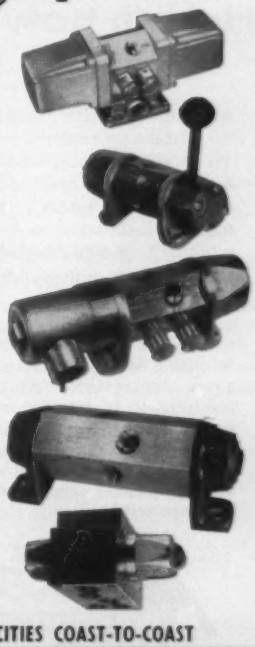

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trouble; but through the use of control charts, it was found that insufficient cooling time had been allowed between operations to permit the hot glass to harden. Retiming the machine greatly improved the yield.

Perfection in every detail is the only proper objective in the design of the production machine. But before the designers can proceed effectively, they must have satisfactory answers to certain major questions: (1) Is the design of the product stable enough to freeze the design of the machine? (2) Have the designs of the product and the machine been thoroughly simplified? (3) Can the machine handle a variety of product types? (4) Can the parts be mechanically handled without damage? (5) Are the product and process tolerances compatible? (6) Is automatic inspection practical and if so, can this information be fed back into the process for self-correction?

Other major considerations in the final design are ease of operation, maintenance and—too often overlooked—appearance and human factors. Machine design is not an abstract art; the machine, after all, is going to be looked at, used by, operated and maintained by—people. Its controls, its indicating and warning systems should be arranged for maximum ease of operation, and its aesthetic appearance needs to be taken into account, too. Accessibility of the components is an important design consideration since downtime is a major factor in the cost of its operation.

Operational Refinements

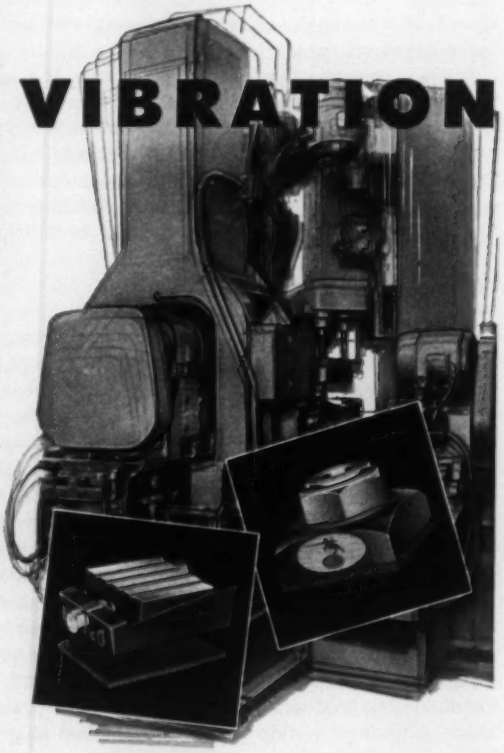
After the production machine is in operation further refinements can be made and usually are. Additional controls may improve product quality and yields. Recently a feedback circuit, using final test information, was added to the switch assembly machine, greatly improving its performance and reducing electrical rejects. Machine operators and maintenance people often offer ideas that contribute to better function, ease of operation, and lower costs.

Four months were needed to prove-in the first 18-head automatic switch assembly machine. During the following six months of production, a number of design weaknesses were revealed and corrected by on-the-spot design changes. Initial production rates were low, but the planned rate of 360 switches per hour was realized one year after the machine was installed.

For the manufacturing engineer the long periods of time between the formation of his ideas and the ultimate completion of the machine may occasionally seem discouraging, but discouragement is forgotten in the feeling of triumphant accomplishment that comes to him and his associates on the engineering team when the effects of so many long months are finally embodied in an automatic machine that is smooth-running, efficient and useful.

From an article entitled, "Designing Automatic Machines" which appeared in The Western Electric Engineer, *Vol.* 1, *No.* 1, *Jan.* 1957.

Here's how to decrease harmful machine VIBRATION



Machine downtime, quality control problems, shortened machine life and loss of precision—*all* can be caused by excessive vibration. To avoid these costly hazards, machines should be *set* level . . . *kept* level . . . and *re*-leveled periodically. *How?* Equip your machines with EMPCO Leveling Jacks! EMPCO Jacks facilitate machine installation and set-ups . . . assure smooth, positive adjustment . . . provide dependable support for machine tools, large surface plates, automation lines, tool room and production equipment of all types.

VI-SORB MOUNTING PADS GIVE EXTRA PROTECTION

VI-SORB Mounting Pads provide extra protection—reduce the transmission of internal machine noises throughout the building structure and check transmitted vibrations from one machine to another. They retard machine creepage and frequently eliminate the need for anchor bolts. VI-SORB Pads do not breakdown under repeated impact loads or deteriorate with age. They resist oils, greases, acids. Available in thicknesses to meet specific conditions and cut to fit EMPCO Jacks. Set your machines level, keep them level, *freer of vibration*, with EMPCO Jacks and VI-SORB Mounting Pads!

EMPCO LEVELING JACKS

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Available in Six Styles—25 Models
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THE ENTERPRISE MACHINE PARTS CORP., 2738 Jerome Avenue, Detroit 12, Mich.

AUTOMATION AND THE ECONOMY

By ROBERT T. SHEEN
President
Milton Roy Co.

ALL OF US are continually confronted by automation in our daily lives. We read about it in the newspapers and magazines; Congress conducts investigations on it; and luncheon speakers choose it as their topic. Undoubtedly the daily exposure to this relatively new term engenders mixed emotions which give rise to many questions. What is automation? Why do we have it? What kind of jobs will it do? What will remain to be done by human beings? What will happen to human dignity as men compete with machines for jobs? How can we use automation to our advantage? And, is automation something we should fight for or against?

Productivity a Factor

What is automation? Perhaps the most precise definition is that automation is the technique of improving human productivity in the processing of materials, energy and information by an extension of the human senses. The words "human productivity" are the important elements in this definition, for automation is the tool by which our nation both maintains and improves our present standard of living.

Automation is worthy of our time and study right now. It may be a complicated technical subject, but it is a realistic, progressive and constructive force in our business and industry. It is a tool that alert management can use to advantage *now*, and will most certainly have to use in the future as the labor market grows tighter and the work week is shortened.

It has been estimated that, by 1975, our population may increase to as many as 220 million people. To provide for this growth of more than 50 million people, and to continue to improve our standard of living at about the same rate that we have in the past, we shall have to produce, by 1975, approximately twice the present output of goods and services. However, our labor force will have increased by only one third. With a lower proportion of laborers and possibly even shorter work weeks, the productivity of each worker will have to increase by more than 50 per cent. In other words, in the next twenty years at least 10 million jobs, and possibly even 25 million jobs, must be filled by automation because there will be no human workers available.

Some Current Fallacies

Automation has been glamorized by such definitions as "manless factories" and "machines that make more machines without human assistance." Unfortunately, automation has also been unjustifiably labeled a method to deprive labor of its livelihood.

These extreme definitions are of course misleading and quite untrue. In a recent report, James R. Bright of the Harvard University School of Business Ad-

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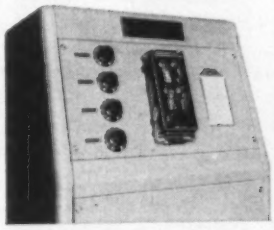
The Richardson Select-O-Weigh system automatically and remotely controls weighing, proportioning and sequencing of ingredients from a single, simply operated panel. To provide the maximum in automation, three means of control for setting up the operation of the panel are now available.



BOSS-BOARD CONTROL PANEL

Contains pre-wired circuits for any weight selection required. Simple contact cords, inserted into board, establish any desired weight combination. Unlimited number of materials in any single batch can be handled.

PCR CONTROL

A punch card reader... governs mixing, blending and proportioning equipment. Reads all 960 positions of an IBM card and also operates with Remington-Rand, Underwood-Samas or custom cards. Absolute privacy of formulas and operating procedures assured.

SELECT-O-WEIGH DIAL

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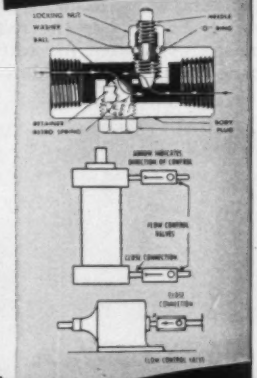
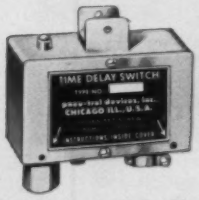
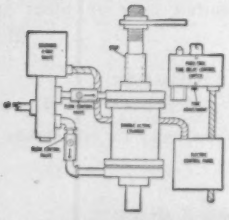
Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to seat, requiring only a slight differential pressure to fully open or close it. Check valves and needle valves, incorporating single function features of Flow Control Valve are also available. All valves made in 5 female pipe sizes: ⅛" to ¾". Valve bodies made from brass, aluminum, steel or stainless steel.



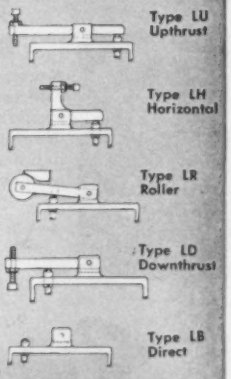
TIME DELAY CONTROL SWITCH FOR PRECISE DELAY OF WORK CYCLE



Provide controlled adjustable time dwell of solenoid operated air or oil supply valves. Range between ¼ and 60 seconds in 20 to 1 ratios. Compact—simple—foolproof—rugged Easily mounted on machine. Available for various types of actuation. Typical diagram below.



For Any Type Actuation Left or Right Hand (Left Hand Shown)



Write for catalogs and complete details

Pneu-trol DEVICES, INC.
Components for Automation
1420 N. Keating Ave., Chicago 51, Ill.

ministration wrote, "For three years I have tried to track down such automatic factories and have been unable to find them. The automatic factory turns out to be in every case a remarkable advance in mechanization, but it has not resulted in manless production."

Similarly, a recent article appeared in a well known national publication which described an automotive engine plant. This article was entitled "Automation: A Factory Runs Itself." In mid-1954, over 4500 people were employed in this plant, with more than 2700 on the production line. These 2700 did not include quality control personnel, material handlers or the maintenance force. It is difficult to understand how a factory with 2700 production line workers can be said to "run itself." In other words automation does not mean manless factories, and none are included in the thinking of realistic engineers and industrialists. In the Detroit automobile factories where the term "automation" was very early used, the number of auto workers doubled in 14 years—and it is estimated that for every new job in the auto industry, five new jobs are created in the allied fields which supply raw materials and auto parts.

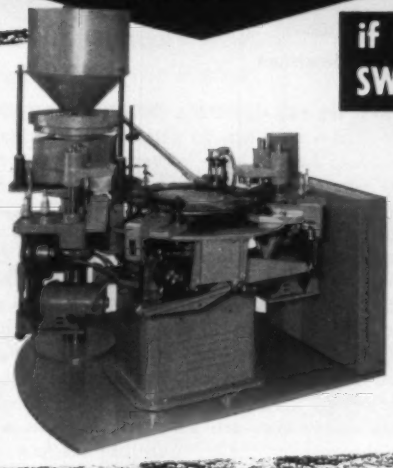
And what of the definition that automation deprives unskilled labor of its livelihood? Consider the dial telephone system. We would certainly think that this form of automation would idle thousands of telephone operators, but we find instead that the number of telephone operators increased by 79 per cent in the ten years from 1940 to 1950; and even today the telephone companies have employment offices to recruit more operators.

Old Concept

There is nothing new about automation except the word itself. In 1784, a Philadelphia flour miller, Oliver Evans, built a flour mill that was just about as automatic as any mill can be. A system of conveyors run by water power unloaded wheat from boats, carried it to the millstones for grinding, and routed the flour to barrels and bags which in turn were loaded on wagons and boats—all without human handling. More than 150 years ago a Frenchman, Jacquard, built an automatic loom which wove intricate patterns in accordance with instructions punched in code on paper. And consider the player piano that is now enjoying a revival. All are forms of automation that have existed for many years. Today we have automatic dishwashers, doors that open as a person approaches the doorway, huge machines that take slabs of metal and turn out finished parts, business machines that store information and solve complex problems, missiles that seek out the target. Automation takes many forms today.

Automation as conceived by the auto industry is no more than super-mechanization. It involves the mechanization of entire sequences of operations. Man is generally no longer the operator of individual machines; rather he has elevated his position and become the monitor of groups of machines. However, I believe automation is only part way along the evolutionary path toward automatic control over production and service processes. We have only start-

You can get this sooner and at lower cost . . .



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You save both TIME and MONEY on your special machines when you start with a Swanson Standard Indexing Machine Chassis. These versatile units give you a headstart on special purpose automatic machines for processing, machining and assembly operations.

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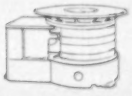
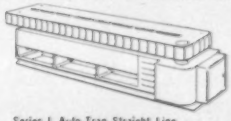


Series H Turret Index Models—for heavy duty applications.



Series L Auto-Tran Straight Line Indexing Chassis—for automatic or semi-automatic assembly and processing operations.

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ed to tap the known technological resources at our disposal which can bring about automatic manufacturing and information handling.

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People are versatile and have the ability to think and reason under new and demanding situations. They will always outperform machines on non-routine tasks and will be required to fill the marketing, management and services jobs attendant with the production of goods; automation will take care of the humanly impossible tasks.

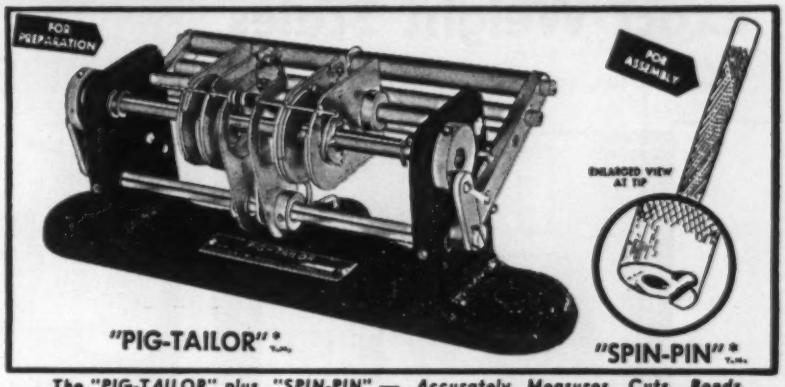
From an industrial manufacturer's point of view there is only one justification for automation—it must make a profit. It is used to increase capacity, often of existing equipment without large capital expenditures. It is also used to improve product quality, shorten lead time, reduce wastage, improve working conditions, reduce maintenance, simplify plant control and administration and reduce floor space requirements. In any particular plant, only one or two of these factors may be primary objectives for utilizing automation, while the others may accrue as unexpected benefits.

As man's basic knowledge increases we can look forward to advanced techniques in automation. For example, the International Geophysical Year which started in July will contribute much to our basic knowledge of the earth and the forces in the universe; much of the knowledge gained may well find practical application in instruments and controls. Scientists from 64 nations are simultaneously studying such phenomena as cosmic rays, the forces of gravity and magnetism, the ionosphere, and the weather. Industry will most assuredly benefit from these studies. Even the special instruments which had to be developed for these studies may eventually be adapted to improve our production methods. Automation then is progressing as man's knowledge increases—and at a rate dictated by our economy.

From a talk entitled, "Automation—A Major Force in Today's Economy" presented to the Rotary Club, Cleveland., Sept. 1957.

"PIG-TAILORING"

. . . . a revolutionary new mechanical process for higher production at lower costs. Fastest PREPARATION and ASSEMBLY of Resistors, Capacitors, Diodes and all other axial lead components for TERMINAL BOARDS, PRINTED CIRCUITS and MINIATURIZED ASSEMBLIES.



The "PIG-TAILOR" plus "SPIN-PIN" — Accurately Measures, Cuts, Bends, Ejects and Assembles both leads simultaneously to individual lengths and shapes — 3 minute set-up — No accessories — Foot operated — 1 hour training time.

PIG-TAILORING provides:

1. Uniform component position.
2. Uniform marking exposure.
3. Miniaturization spacing control.
4. "S" leads for terminals.
5. "U" leads for printed circuits.
6. Individual cut and bend lengths.
7. Better time/rate analysis.
8. Closer cost control.
9. Invaluable labor saving.
10. Immediate cost recovery.

PIG-TAILORING eliminates:

1. Diagonal cutters.
2. Long-nose pliers.
3. Operator judgment.
4. 90% operator training time.
5. Broken components.
6. Broken leads.
7. Short circuits from clippings.
8. 65% chassis handling.
9. Excessive lead tautness.
10. Haphazard assembly methods.

* PATENT PENDING

Write for illustrated, descriptive text on "PIG-TAILORING" to Dept. A-10P

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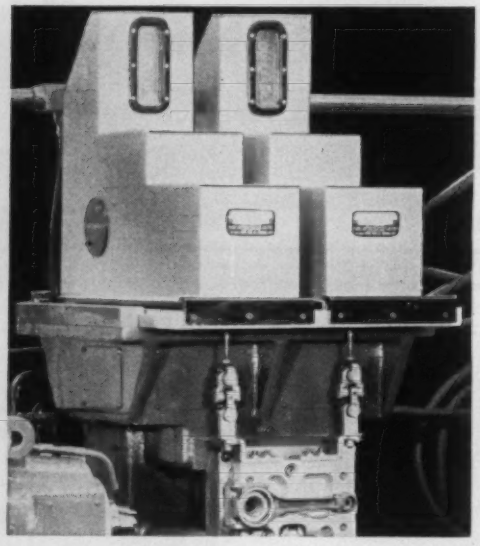
Another report on

Exact Weight Scales

in Automation



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Automatic Balancing of Connecting Rods

Perfect balance in connecting rods is assured by utilizing the two Exact Weight Shadographs shown above integrated with a milling machine. Operation is entirely automatic.

The Shadographs, a new concept of precision scales, are especially designed to weigh both ends of the work piece. Weight distribution of each piece is registered by the Shadographs and signals are automatically transmitted to stations on either side. Balancing is accomplished by one-pass milling to tolerances of 1/16 ounce (1.7 grams) in either end or overall weight. Rods which do not meet maximum milling dimensions are automatically rejected.

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AUTOMATION patents

Copies of patents are available at 25 cents each from the Commissioner of Patents, Washington 25, D.C.

MEASURING APPARATUS USING A LIGHT BEAM

Position of a movable table on a machine tool is determined by use of light rays reflected from a scale having division marks of different light reflective properties with relation to a scale on the frame. Difference in voltages of two photoelectric cells indicate differences in reflected light. Patent 2,795,992 by Deh Chang Tao, assigned to Portage Machine Co.

DEVICE FOR MAINTAINING CONSTANT WEIGHT BALES

Size of a bale-forming chamber is varied by the action of a hydraulic cylinder. Supply pressure to the cylinder is controlled by a relief valve whose setting is regulated by the position of a scale platform that weighs the preceding bale. Patent 2,796,825 by George M. Kriegbaum, James H. Bornzin and Howard F. Bardwell, assigned to International Harvester Co.

ARTICLE RECEIVING APPARATUS

Articles having downwardly projecting parallel leads are dropped from a moving conveyor onto a brush. The leads pass down between the bristles and hold the article in vertical position until the brush is moved to an unloading position. Patent 2,796,976 by Willard G. Otto, assigned to Western Electric Co. Inc.

DEVICE FOR THE AUTOMATIC METERING OF LIQUIDS BY MEANS OF PNEUMATIC CONTROLS

Container to be filled is supported by a weighing means, and through use of pneumatic bellows the flow of liquid to the container is automatically controlled. Patent 2,797,060 by Aldo Malafarina and Alberto Filippi, Milan, Italy.

MAGNETIC TRANSDUCING WEBS AND METHOD OF MANUFACTURE

Magnetic tape which is smooth-surfaced on both faces is continuously formed by successively applying and drying on a carrier web a layer of resin bearing magnetic pigment and a layer of plastic, and then stripping the composite tape from the carrier. Patent 2,799,609 by Harold R. Dalton.

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Floor-to-Floor CONVEYORS HAVE MANY USES

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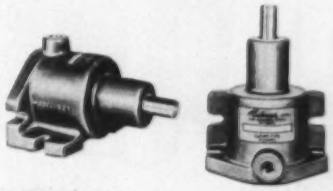

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SLOTTED MOUNTING HOLES save installation, relocation time.

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Bore Size	Price (f.o.b. factory) 1" Stroke	2" Stroke
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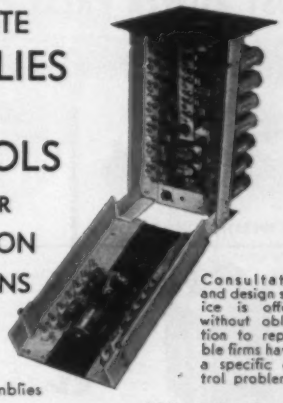

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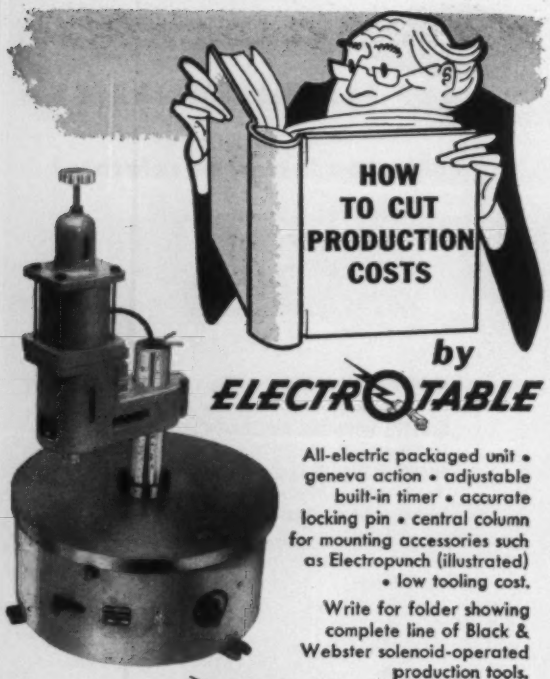

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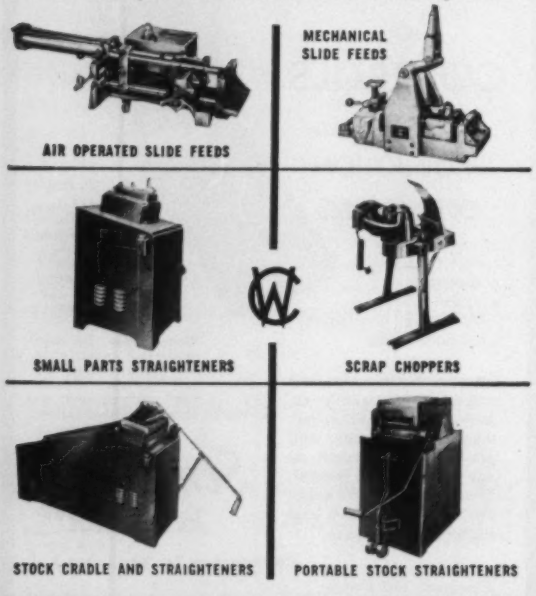

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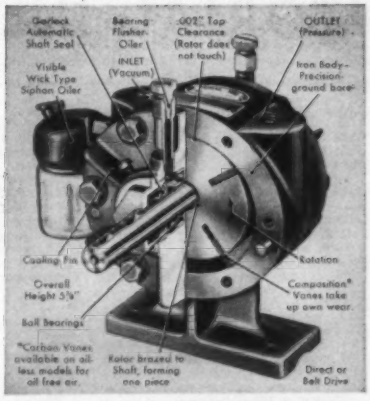
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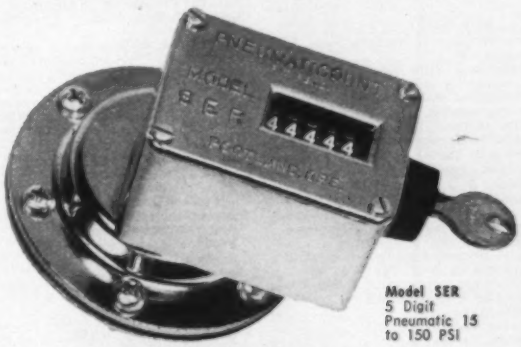

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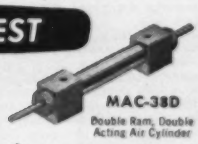
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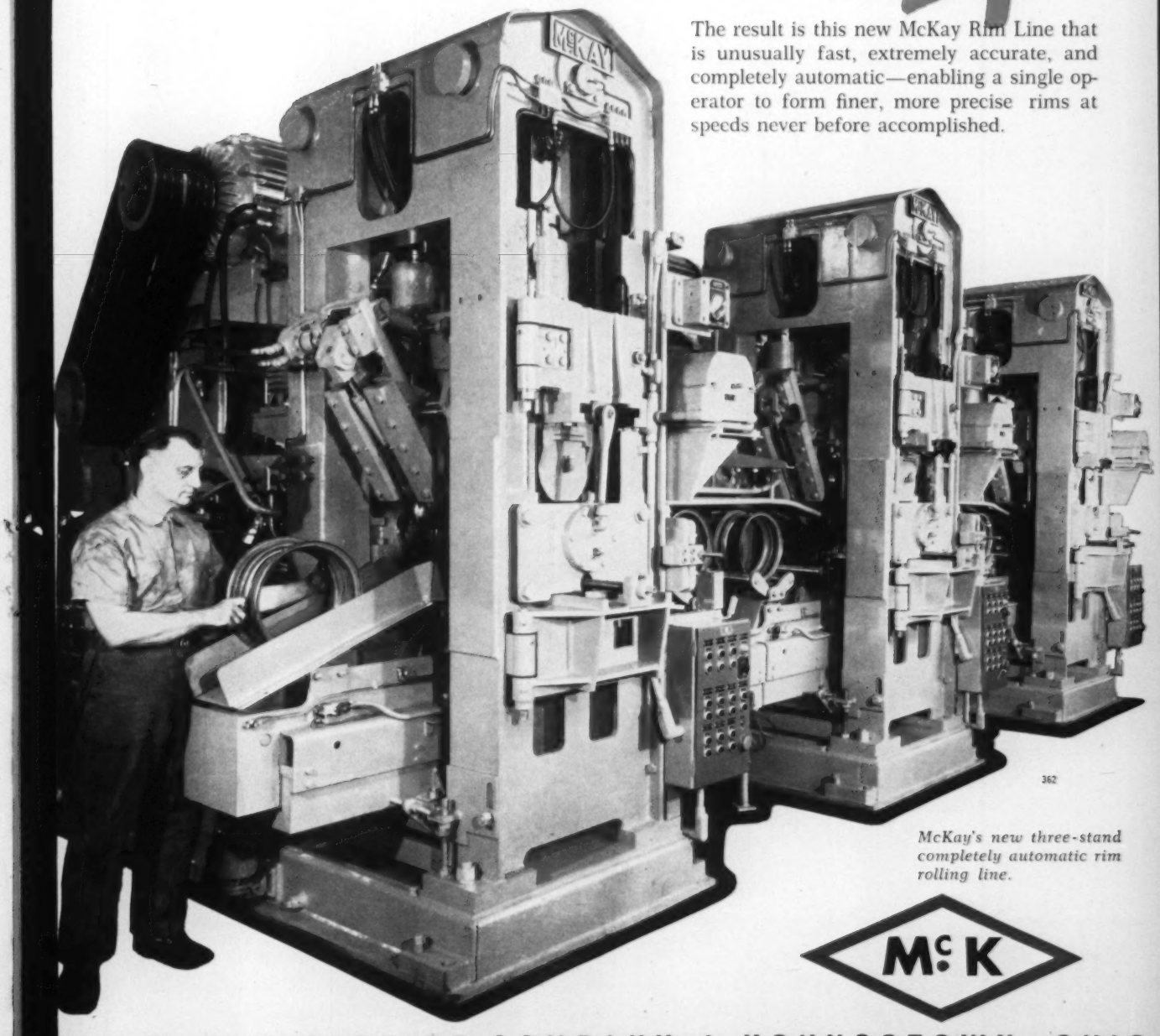

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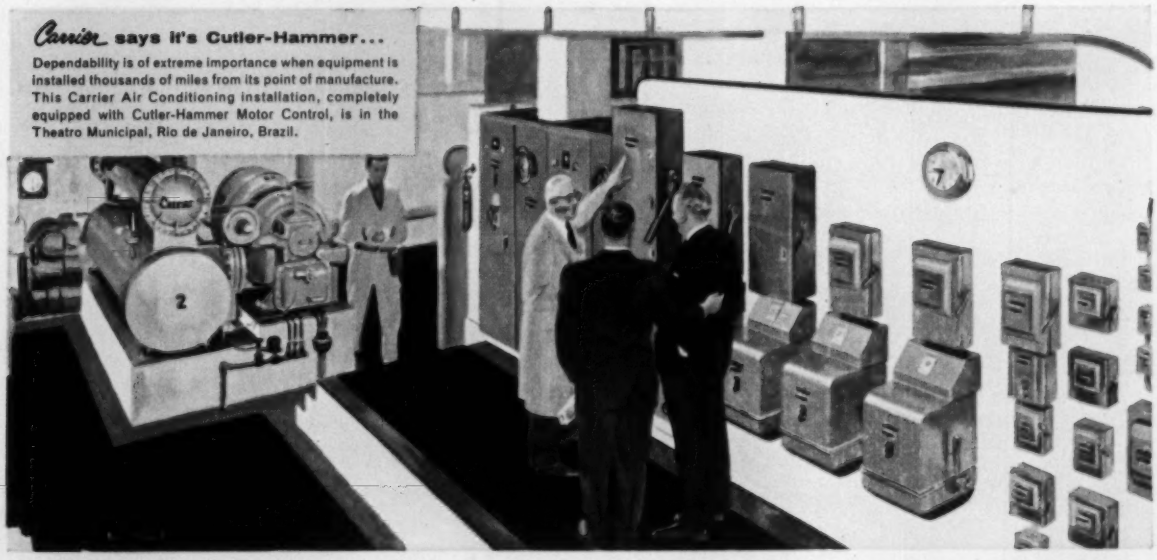

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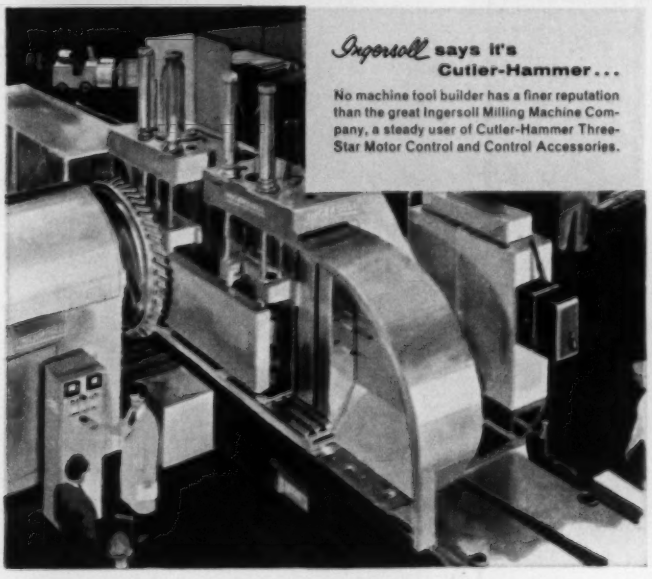

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